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OF THE

SECRETARY OF WAR;

BEING PART OF

THE MESSAGE AND DOCUMENTS

COMMUNICATED TO THE

TWO HOUSES OF CONGRESS

AT THE

BEGINNING OF THE FIRST SESSION OF THE FIFTY-SECOND CONGRESS.

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Annual report 1890/91

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U. S. Army. Signal Corps. "Annual report, 1890/91

REPORT OF THE CHIEF SIGNAL OFFICER.

SIGNAL OFFICE, WAR DEPARTMENT,
WASHINGTON CITY, *October* 10, 1891.

Honorable REDFIELD PROCTOR,
Secretary of War:

SIR: I have the honor to submit the annual report of the operations of the Signal Corps for the fiscal year ending June 30, 1891.

REORGANIZATION.

The Signal Corps has been completely reorganized during the past year, the military branch having been placed on a fixed and permanent footing, tending to greater efficiency, while the civic duties have been fully, definitely, and finally transferred as the United States Weather Bureau to the Department of Agriculture. This reorganization resulted from the recommendation of the President in his first annual message, which recommendation finally became law by the act of Congress approved October 1, 1890, which defines the military duties of the Signal Corps of the Army, as follows:

"Section 2. That the Chief Signal Officer shall have charge, under the direction of the Secretary of War, of all military signal duties, and of books, papers, and devices connected therewith, including telephone apparatus, and the necessary meteorological instruments for use on target ranges, and other military uses; the construction, repair, and operation of military telegraph lines, and the duty of collecting and transmitting information for the Army by telegraph or otherwise, and all other duties usually pertaining to military signaling; and the operation of said Corps shall be confined to strictly military matters."

At present the Signal Corps is composed of a Chief Signal Officer with the rank of brigadier general, one major, four captains (mounted), four first lieutenants (mounted), together with ten first-class sergeants and forty sergeants. The officers of the Corps, appointed in February last, were selected from officers of the Army, with particular reference to their merit, which was largely determined from former service with the Signal Corps. In selecting the Board of Officers to pass on the comparative merits of the applicants, the Secretary of War so constituted it that the members represented the volunteer soldier, the scientific professions, and the trained graduate of the U. S. Military Academy. The recommendations of the Board, and of the Chief Signal Officer, were fully approved by the Secretary of War and concurred in by the President.

The sergeants in the Signal Corps have been selected in part from the old members of the Corps, and in part from numerous candidates among non-commissioned officers of the line, those being transferred whose education, special training, soldierly conduct, and moral standing gave promise of greatest usefulness.

DIVISION OF MILITARY SIGNALING.

In Appendix No. 1 is set forth by Captain R. E. Thompson, Signal Corps, the progress and condition of military signaling in the Army during the year.

First Lieutenant J. E. Maxfield, Signal Corps, stationed at Fort Riley, Kans., was temporarily called away from his instruction duties in order to participate in field operations near the Pine Ridge Agency. He has returned to Riley and is engaged in instructing sergeants of the Signal Corps. First Lieutenant Frank Greene, Signal Corps, assigned to duty as Chief Signal Officer of the Department of Arizona, supervises signal instruction in that department, and in addition manages with energy and satisfaction the difficult telegraph lines of Arizona.

The establishment of a Signal Corps of the Army upon a permanent basis does not entirely relieve the Chief Signal Officer of the Army from embarrassment in the performance of strictly military duties, since the Corps remains unprovided with facilities for using the present antiquated field-telegraph train, or with proper means for improving its condition. The experience of the rebellion taught the impossibility of the ablest officers, no matter how thoroughly informed as to theory, to immediately and effectually perform technical duties which they had considered only from a strictly theoretical standpoint. Experience and practice are the safest criterions of efficiency. In all foreign armies the principles enunciated by Napoleon, that speedy communications are guarantees of success, are acted upon. The military world elsewhere regards as indispensable auxiliaries to military operations the perfecting of field telephone kits, the raising to a high degree of efficiency field telegraph trains, and the development of other adjuncts necessary to insure speedy communication. The highest talents and the most acute minds are now applied to the development and extension of motors and methods for speedy and increased communication, both bodily by transportation lines and mentally by telegraph and telephone. In foreign armies the results of such inventions are quickly applied to the solution of professional problems arising in connection with military duties, and if the professional standing of the American Army is to be maintained, similar application must be made in this country, otherwise a few years would leave the entire army unskilled in the most important of modern appliances.

The radical change in strategic operations involving the movement of separate bodies of troops is strikingly illustrated by Von Moltke in his determination to unite his armies within his adversaries' country at Gitschin, "he moved his two separate armies by means of the electric telegraph with as complete precision as if they had been concentrated under his own eyes," and so assured was he of the certainty and speed of this method of communication that even after his armies had made their way into the heart of the enemy's country "instead of at once uniting he kept them designedly at least one day's march apart, in the hope of securing the tactical advantage of engaging his enemy in front with one whilst he fell upon his flank or rear with the other, which he actually did subsequently." Lord Wolseley, in criticising Von Moltke's tactics, says "to have attempted such an operation as his invasion of Bohemia before the electric telegraph was invented would have been mad rashness," and he draws the conclusion that to excel the general must study not only the inventions and most recent discoveries in applied science, and the improvement in the mechanical implements of the day, but he must catch eagerly at those which he sees looming up in the distance.

At the end of the rebellion, the Signal Corps of our Army was the most efficient in the world, and now, while foreign governments are extending its means and improving its methods, having copied the American idea of army signaling, the Chief Signal Officer feels impelled to urge upon Congress the importance of providing suitable means for the regular instruction and drill of the officers and men of the Signal Corps, who, otherwise, must steadily retrograde and become unfitted for such work under difficult conditions. Ample material and support are necessary to raise the Signal Corps to a high standard of efficiency and keep abreast of modern progress. The telegraph, the heliograph, the electric flash-light, and the telephone have become potent factors in civilized warfare, and any neglect to provide suitable means for a military corps charged with the study, practice, and operations of the same, cannot commend itself to any thoughtful legislator. While millions of dollars are being appropriated for our coast defenses, the Signal Corps has found itself unable to furnish needful telephones, telegraph lines, and other electrical apparatus for artillery ranges. Practice in constructing and maintaining telephone lines and field telegraph trains can be had at inconsiderable expense, and with great advantage in connection with summer campaigns and marches of the regular Army, and particularly with the large camps of the militia of the various states.

In her strenuous efforts to improve the efficiency of her army, France felt the necessity of sure and rapid means of conveying orders from the commanding general to his division commanders, and special efforts have been made in this direction. As a result the French military authorities congratulate themselves on the speedy and accurate manner in which the military manœuvres of this year, involving the handling of 150,000 men over a limited territory, were accurately and promptly performed without disorder or delay. In this mobilization, says one of the French journals, the system of communicating orders by electric lines of permanent and temporary character was perfected to such an extent as to elicit especial commendation from the commanding general.

In the French manœuvres referred to it appears that the use of the captive balloon, initiated by McClellan at Yorktown in 1862, has been carried to a successful stage by European experts. A captive balloon was kept in constant communication by means of telephones with the Commanding General, and the post of observation was so commanding that no movement of any considerable body of troops by the enemy was possible without speedy detection and report. The Chief Signal Officer has long appreciated the importance of balloons in active military operations, and he has made a special estimate for the purchase and construction of a military balloon train, which is a necessary adjunct to the permanent equipment of the Signal Corps.

The necessity of determining by experiment the most serviceable and suitable mechanism for a powerful flash light demands instant and careful consideration at the hands of this Corps, and a small appropriation is asked therefor. Such powerful lights are indispensable to successful night signaling, and in addition are absolutely necessary for use as search lights for detecting and neutralizing night assaults on permanent or temporary earthworks and also on exposed camps.

It is most desirable that appropriations for flash lights and balloons be made during this fiscal year, in order that these important outfits may be practically exhibited at the World's Fair in 1893.

SEACOAST, MILITARY, AND TELEGRAPH LINES

Major H. H. C. Dunwoody, Signal Corps, in Appendix No. 2, states the condition under which the military and seacoast telegraph lines have been maintained and operated during the fiscal year. Under the act of Congress approved October 1, 1890, the coast lines (634 miles in length) were designated for transfer to the Department of Agriculture on July 1, 1891, while the lines maintained for strictly military purposes (1,025 miles in length) remain under the charge of the Chief Signal Officer of the Army.

The seacoast lines have suffered material interruption during the year on the Atlantic coast from Cape Charles, Va., *via* Norfolk, to Hatteras, N. C.; the cable across Oregon Inlet had its shore ends drawn from their landings by the violent storm of January 16, 1891, while the cable from Cape Henry to Cape Charles was broken, presumably by the anchor of a vessel. The Oregon Inlet cable was so deeply buried in the sand as to render its recovery impossible, and it was replaced on June 7th by a new cable of much heavier material. Like the former, the new cable has two conductors, of which one is placed at the disposal of the U. S. Life Saving Bureau. Owing to insufficient funds, nothing could be done with the Cape Charles cable, except to buoy and secure it, until July last, when funds would become available for final and complete repairs.

During the year the Tatoosh Island cable and land line have remained inoperative, owing to the insufficiency of the special appropriation for repairs. The sum of $6,800, estimated for originally, was based on the importation of a cable free of duty, but as subsequent legislation required the imposition of such duty, it became necessary to ask an increase of the appropriation to cover this difference in the cost, which increase was granted by Congress and incorporated in the appropriations for the coming fiscal year. A new cable has been contracted for, and the work of reconstructing the land line between Port Angeles and Cape Flattery commenced, so that telegraphic connection with Tatoosh Island should be renewed on or before August 1, 1891.

The value of the seacoast lines has been demonstrated during the past year. Shortly after the loss of the Oregon Inlet cable, there occurred in the immediate vicinity three shipwrecks, involving the loss of nineteen lives, and emphasizing the importance of telegraphic communication along the dangerous coast of North Carolina. During the year four vessels, through timely warnings over the Point Reyes line, were saved from destruction, the most notable case being the British ship "Jessamine," February 22, 1891, whose equipage of twenty men and valuable cargo were saved through prompt action in sending relief. On the Nantucket system of cables and land lines, the Signal Corps operator at Vineyard Haven, establishing a flying station at Gay Head in connection with the wreck of the U. S. steamers "Galena" and "Triana," rendered valuable and efficient services which were acknowledged by the Secretary of the Navy in a commendatory letter.

The Chief Signal Officer commends especially the satisfactory service rendered by the enlisted men and civilian operators in connection with the military telegraph lines, whether on the seacoast or inland, which, remote from centers of civilization, necessitate prolonged and monotonous hours of duty every day of the year, and also physical hardship resulting from the necessary exposure during extended repair trips. The seacoast lines have been extended from 621 to 634 miles in length, owing to changes in the Point Reyes line rendered necessary by the approaching transfer and consequent separation of seacoast and military telegraph lines.

MILITARY TELEGRAPH LINES.

The Chief Signal Officer has followed the previous policy of discontinuing military telegraph lines wherever the extension of railway or commercial telegraph lines, or the abandonment of military posts would permit. During the past year these lines have been reduced from 1,337 to 1,025 miles in length.

The most important divisions are in the Department of Arizona, where 417 miles are in operation, and in the Department of the Platte, where 290 miles are maintained and operated. There appears no immediate probability of material reduction in the length of these which, as a rule, may be said to be indispensable to efficient and economical military operations in connection with Indians.

The mixed military and seacoast telegraph system connecting Point Reyes and the military posts in the harbor of San Francisco with the Signal Office, has been maintained with a fair degree of efficiency during the year. The unfortunate accidents to the military cable in the harbor of San Francisco, conjoined to the breaking of seacoast cables in Chesapeake Bay and on the North Carolina coast, with the limited appropriation, rendered it impossible to lay a new cable in San Francisco harbor. It was, however, possible to restore communication by patching up the cables with heterogeneous and unsuitable old material. The importance of coast defenses in connection with the harbor of San Francisco demand imperatively that a new cable should be laid, and an estimate therefor will be submitted.

WEATHER FORECASTS AND STORM WARNINGS.

The prompt and regular issue of weather forecasts and storm warnings has been possible only through the remarkably efficient telegraph service rendered by the Western Union and other telegraph companies. It is simple justice to the Western Union Telegraph Company, which corporation handles nine-tenths of the weather reports, to say that despite the fact that during the fiscal year no compensation was paid this company, owing to pending controversy regarding rates, such conditions have not impaired the efficiency of its telegraph service; indeed, in the past two years the circuit reports have been handled with unprecedented accuracy and speed, while the special service has been most satisfactory.

Only one serious interruption in the telegraphic service occurred during the year, when the heavy sleet storm of January 24-25, 1891, destroying direct communication with New York City for several days, delayed beyond ordinary circuit hours the receipt of reports from New England and New York. In this case, as in previous years, the Western Union Telegraph Company placed their only wire at the service of the Signal Bureau, and handled with great celerity these reports by a circuitous route *via* Chicago, Cincinnati, and Augusta, Ga.

The method adopted of comparison between the official forecasts and the subsequent weather conditions by a disinterested professor has placed the Bureau beyond the suspicion even of prejudice in this direction. The percentages, set forth in Professor Marvin's report (Appendix No. 3), are believed to represent with close approximation the success of the forecasts, both as regards public impression and also as showing the mathematician's conclusions drawn from definite and indisputable observations. It must be said, also, that it is not claimed that these results are strictly comparable. The great and almost inseparable difficulty in weather forecasting relates to the exact prediction of rain as regards both areas and time. The officer having a fair weather month, other things being equal, will have a higher percentage than his intellectual superior with an unsettled month. This is shown conclusively by the forecasts for the Pacific coast, where southern California, with its settled weather, gives about eight per cent. higher verification than Oregon. The question of weighting predictions according to their difficulty has been considered, but it was decided that the results would not be worth the time necessary for such close analysis. The yearly averages of temperature and weather combined for the past three years are: 1889, 81.0; 1890, 82.6; and 1891, 83.5. A very gratifying improvement is also found in the successful wind signals, as follows: 1889, 67.3; 1890, 67.1; and 1891, 70.9.

The highest percentage in weather was obtained by 1st Lieutenant W. A. Glassford, in February, viz., 90.4, the highest, it is believed, made since the prediction by states began. The highest average in temperature was also attained by the same officer in the same month, 84.3. The percentage for signals shows the highest by Professor Hazen, viz., 82.1, in March.

The marked differences between percentages of signals verified during the winter and summer months makes it inappropriate to draw for each official general averages based on all classes of forecasts, as had been contemplated by the Chief Signal Officer, so that until a correction due to the season can be satisfactorily determined, it is fairer to all officials concerned to publish their percentage for each class of work. If the other course was followed injustice would be done by comparing the work of a professor to his disadvantage, if his signals were displayed in the month of light and variable winds, with that of his brother professor, whose signals were displayed in the month when the winds were highest and most frequent.

Long time forecasts of weather and temperature have been issued at the discretion of the forecast official with successful percentages of 84.1 for 48 hours and 87.1 for 72 hours. These forecasts are made for extensive sections of the country. The forecasts for 72 hours (1,121 in number) were infrequent as compared to those for 48 hours, which aggregated 2,189 predictions.

This very gratifying improvement on the forecasts for 1891–1890, of 2.5 per cent. for the 48-hour predictions and 5.7 per cent. for those of 72 hours, gives indication of what the country may reasonably expect from future predictions of this character. The issue of these forecasts is entirely optional with the forecast officials. In this class of work, Captain James Allen, Signal Corps, and Prof. H. A. Hazen have shown great willingness to venture, in the interest of the public, on predictions for two or three days in advance, Captain Allen making 891 predictions during the year and Professor Hazen 552.

The following-named officers have performed the difficult and arduous work of forecasting: Major H. H. C. Dunwoody, Signal Corps, August and January; Captain James Allen, Signal Corps, July, December, and April; Captain R. E. Thompson, Signal Corps, September; Lieutenant W. A. Glassford, Signal Corps, October and February; Prof. H. A. Hazen, November, March, and May; Lieutenant John P. Finley, 15th Infantry, for the Pacific Coast region during the entire year. The detailed standing of these forecast officials appears in Appendix No. 3.

COLD WAVE AND TEMPERATURE WARNINGS.

Prof. Thomas Russell remained in charge of this important duty until relieved in May, 1891. His report forms Appendix No. 4. The percentage of success under the present rigid rules was 59.2, an improvement of 4 per cent. over the work of last year. Under this system of verification all cold waves missed, or those which do not come within the prescribed time, are counted against the official.

LOCAL FORECASTS.

The plan initiated by the Chief Signal Officer a few years since, of authorizing the most competent observers of the Service to make local forecasts for their own station and immediate vicinity, has been very highly gratifying in its success, and no less than forty-five observers at the date of this report are making, with a fair degree of success, forecasts of the weather and temperature for their stations. Although this marked step in advance has been practically made, yet it was not until the present year that the Chief Signal Officer succeeded in having this system officially recognized by Congress. The appropriation made by the last Congress incorporated therein unchanged the estimates made by the Chief Signal Officer, whereby twenty of these competent and deserving observers will be officially recognized in their position as local forecast officials with increased compensation for these important duties. It is hoped and believed that this system, initiated by the Chief Signal Officer, will be further extended during the coming year. The local forecasts thus made have been given equal or greater prominence than the forecasts made at Washington, and in no case has the publication of the local forecasts been delayed in order to distribute with them the general forecasts made at the central office at Washington.

WEATHER AND COLD-WAVE SIGNALS.

There are no less than 1,127 stations to which weather, frost, and cold-wave signals have been distributed by telegraph at the expense of the Government, at such period of the year as each displayman desires them.

WEATHER MAPS.

The gratuitous issue of semi-daily weather maps to commercial bodies, adjacent post offices, educational institutions, railway stations, and prominent business firms has been continued during the year with increased interest and efficiency. There are no less than fifty stations from which the current maps are sent out by messenger or mail within an unusually brief time, averaging less than two hours after the receipt of the last telegraphic report. Six stations send both the night and the evening edition, viz.: Boston, Chicago, Cincinnati, Harrisburg, New York, and Saint Louis.

At a few stations the type in use is becoming illegible, but the sub-appropriation would not permit its replacement, which, contemplated this year, had to be deferred, owing to the insufficient sub-appropriation. Each observer has been permitted to use the method with which he thought the best results could be obtained, whether costly or cheap, by regular type with metal symbols, by milleograph, or by cyclostyle.

Very marked improvements in the general appearance and legibility of the maps have been made during the year. The Chief Signal Officer became satisfied, on a personal consideration of the subject, that at all stations, as at Washington, maps, in addition to the usual lines of equal temperature and pressure, could also graphically exhibit marked changes in temperature and excessive rainfall over extended areas since the last report. Sergeant John W. Smith, on duty at Boston, Mass., one of the most competent observers in the Service, having been personally directed to experiment in this direction, soon demonstrated the possibility and legibility of such graphic methods which before seemed impracticable with the small means and economical devices in vogue at stations. Later, Sergeant L. M. Dey devised a shading apparatus for these conditions by using colored inks, applied with corrugated rollers. The application of these methods has become as general as the limited sub-appropriation would permit, and the style and class of maps now put forth by many observers of the Signal Corps leaves little to be desired either in legibility of text, in clearness and simplicity of graphic methods, or in artistic excellence. The plan adopted by the Chief Signal Officer of complimenting monthly the five observers who excel in map work has stimulated the activity of all observers, and resulted in an unusually large proportion of observers becoming more or less expert as map makers. Further liberty has been given observers in their methods of map making, whereby each observer was directed to himself carefully consider, and also to consult local authorities as to the business interests most intimately concerned in the prompt and legible dissemination of meteorological information, in order that the local map might contain such data as was most acceptable and of the greatest benefit in their respective localities. A standard map, based on the observer's recommendation, was then approved for each station, from which, in order to secure uniformity, no deviation is permitted except on a renewed recommendation of the local observer.

No doubt exists that, at present, the maps issued by this Service are unrivaled as to their legibility, simplicity, and general appearance, while as to promptness of issue, and its extent, whether in number of copies issued or distance sent, the Signal Service of the United States is not even approached by any other meteorological service.

The number of maps issued during the year exceeds considerably one and one-eighth million copies, and even this large number is entirely inadequate to meet the growing wants and demands of the country, and was assisted during the past year by the sub-appropriation available, which amounted to only $15,000. There is no reason why, with the liberal and unrestricted appropriation for the next year, the issue should not reach 1,500,000 copies.

It is proper to remark that the remarkable increase for the past four years has been a strictly legitimate, healthy growth, resulting from increased interest in the subject of the weather. The Chief Signal Officer has followed a progressive policy as to the distribution of these maps, and has disapproved and discouraged any methods calculated to build up an apparent or fictitious circulation of these valuable publications.

The following list shows the increased circulation since 1886, when the Chief Signal Officer took charge of this work:

Issued at—	1886-'87.	1887-'88.	1888-'89.	1889-'90.	1890-'91.
Washington City	126,000	117,750	175,000	193,140	191,846
Other stations	52,248	274,411	683,947	876,394	1,007,156
Total	178,248	392,161	858,947	1,069,534	1,199,002

That the increase of interest is among the people at large, and not stimulated at the central office at Washington, is shown by the fact that the increase in issue at the central office in the past five years has been only 52 per cent., which corresponds closely with the increase in the general work of the Bureau. Outside of Washington, however, the maps issued increased from 52,248 in the fiscal year ending June 30, 1887, to 1,007,156 copies in the past fiscal year, an increase of 1,828 per cent. in five years. Formerly the issue of maps for the entire country outside of Washington amounted to less than one-third of the whole number; at present it exceeds 84 per cent.

WEATHER REPORTS FROM THE WEST INDIES.

The project of obtaining reports from the West Indies by the cooperation of the United States consuls, which was under consideration last year, was successfully put in operation early in the present year. Through the courtesy of the Department of State, the Chief Signal

Officer perfected arrangements for the establishment of auxiliary stations at Saint Thomas, San Domingo, Kingston, and Santiago de Cuba. Two observations are taken daily at specified times, and in case of marked atmospheric changes a special observation is at once taken and telegraphed. For economic reasons, but one special report is paid for daily. The period of observations is from July 15 to October 15, or in other words, during the hurricane season.

These reports from the West Indies are telegraphed by special message to the observer at Key West, Fla., who enciphers them in the code used by this Service, combines them in one special message and telegraphs them to the observer at Jacksonville, Fla., at which point they are placed on the Jacksonville and Washington circuit and thus reach the central office. By special arrangements with observers at the West India stations, cablegrams, at the expense of this Service, are also sent at the approach of hurricanes from October 15 to July 15.

Correspondence was had with Prof. Charles Carpmael of the Canadian Meteorological Service, with a view of receiving reports from Bermuda Island through the Toronto office, which will be done as soon as that service perfects its arrangements with the Halifax Cable Company as to the rate to be paid. In the meantime, whenever unusual meteorological conditions obtain at Bermuda, this service reports direct from that island at the expense of the United States through the courtesy of General Russell Hastings, who voluntarily and personally performs this valuable scientific work for the Signal Office.

Through the courtesy of Professor Carbonnelly, Director, Maritime Meteorological Office, Havana, Cuba, daily reports have been received regularly from Havana. The Chief Signal Officer acknowledges with pleasure the continued interest and co-operation of Padre Vines, S. J., in connection with hurricane reports and forecasts.

HYDROGRAPHIC OFFICE.

During the past year the observers in charge of the stations at Brownsville, Charleston, Eastport, Galveston, Key West, Mobile, New London, Pensacola, San Diego, Southport, and Wilmington have continued to perform for the Hydrographic Office of the Navy such maritime meteorological work as would not interfere with their regular station duties.

RIVERS AND FLOODS.

Prof. Thomas Russell has continued in charge of the river and flood service of this Bureau during the year. It has been long evident to the Chief Signal Officer that this division was one of such importance as to command the complete attention of one of the professors of this Service, consequently Professor Russell was relieved in May, 1891, from all other duties, and was directed to devote his entire attention to a careful investigation of flood conditions in order that satisfactory rules for predicting the stages of rivers might be elaborated.

Observations of the heights of rivers have been made at 27 regular Signal Service stations and at 109 special river stations. Supplementary to these, 50 rainfall stations, located on the headwaters of the most important tributaries of the great rivers, have been maintained, since speedy and accurate information of heavy rainfalls at such points is of great importance in forecasting river changes. Thirty-eight special river stations have been established during the year, a majority of these being in the south Atlantic states, for the benefit of the various industries along the Alabama, Coosa, Tallapoosa, and other rivers in that section.

During the time of the high water in the Ohio and Mississippi rivers, when a heavy rainfall of a single day might have brought about a recurrence of disastrous floods, special attention was given to distributing widecast through the sections interested, bulletins showing the daily stages and changes, accompanied by definite predictions for several days in advance. Professor Russell announced with a close degree of approximation the crest of the high waters expected, which predictions were well verified both as to date and stage.

On April 2, owing to the threatening condition of the rivers and the general feeling of insecurity engendered by the disastrous floods during the spring of 1890, the Chief Signal Officer put forth a special river bulletin for the lower Mississippi valley, wherein he set forth that the river at Cairo would rise in the next week to about 45 feet, but that the high stage of water then prevailing in the lower rivers (48 feet at Vicksburg) could scarcely be maintained, and that any further rise would not exceed a few tenths of a foot. This forecast, which proved to be correct, restored the confidence of the people in the lower Mississippi valley. Special reports and timely forecasts were furnished to engineers in charge of levees, and to other interested parties in the threatened districts.

As will appear from Professor Russell's report (Appendix No. 4), the correct warnings, given in ample time, proved to be of great benefit to owners of stock and other exposed and movable property.

The important work of devising satisfactory rules for forecasting river stages has been pursued by Professor Russell, and his results are incorporated in the report submitted herewith, wherein they are properly entitled: "Practical Rules for the Prediction of Flood Stages of Rivers in the United States."

Despite the long-continued series of river observations, covering many years, this is the first attempt to utilize the records in the derivation of practical rules for forecasting. These rules cannot be determined with the same degree of accuracy for every place, since, as a rule, the less the proportion of drainage area between two dependent gauges on a river, so much the more accurately can the resultant stage at the lower one be predicted. For instance, the stage of the Ohio River at Cincinnati, produced from a drainage area of 78,000 square miles of territory, is the result of the stages of two or three days previous at Parkersburgh, W. Va., Charleston, W. Va., Louisa, Ky., and Circleville, Ohio, but as there are over 20,000 square miles of drainage area between the last point named and Cincinnati, the prediction of the river stage for the last named point must be somewhat indeterminate. Other sources of uncertainty are indicated by Professor Russell in his most valuable and interesting report (Appendix No. 4). He further points out that the proportional effects from rise of the different tributaries can be ascertained only by discharge measurements, since the same stage of water on different rivers corresponds to very different quantities of water and area of cross section of the river. It is therefore to be anticipated that more satisfactory rules for predicting river stages can be formulated in proportion as river records, covering extended periods, become available. Doubtless, too, the analysis of rainfall observations, which Professor Russell is now undertaking, will result in an improvement of the rules. By the present rules the greatest error in a predicted stage for Cincinnati should not exceed three feet, and for Cairo and the lower Mississippi river it should be much less. The probable error at Cairo is not plus or minus 1.2 foot, while the largest error likely to occur is placed at 3.0 feet. These errors result largely from the fact that above Cairo there are drainage basins of 108,000 square miles which do not pass Saint Louis, Cincinnati, Chattanooga, or Nashville, the places on whose gauge readings the predictions for Cairo necessarily depend. However, even with present imperfections in records and methods, the predictions for the Mississippi and Ohio this year gave very general satisfaction. The special bulletin issued February 25, 1891, gave the forecasts and stages for five places in the lower Mississippi valley, for nine to thirteen days in advance, with such a degree of accuracy that the actual stages differed from the predicted results only by about one-tenth of a foot, while the maximum error was only four-tenths of a foot.

The relative effect of different rivers in producing freshets waves might be supposed (though incorrectly) to be nearly proportional to their drainage areas. It is important to note that the average slope in drainage basins and the permeability of the soil determine largely the action of rivers in producing floods. Professor Russell is investigating rainfalls in detail, and expects to ascertain for each river basin the quantity of rainfall, its distribution, and the consequent recurring river stages.

Professor Russell also expects much from gauging the important tributaries of the Ohio River, viz.: the Wabash, Green, Kentucky, Big Sandy, for which purpose Congress has appropriated $4,000 for use during the coming fiscal year. The method proposed for this work appears in Professor Russell's report.

Considering the enormous amounts involved in the interests of our navigable rivers, it may safely be said that there is no branch of the Weather Service from which the public derives so much benefit, in proportion to the sum expended, as from the River and Flood Division, with its special sub-appropriation of $17,000.

There has been continued during the year the publication, by the milleograph process, of the stages of the principal rivers of the United States. The following three parts of this very valuable compilation have been completed:

"I. Stages of the Ohio River and its principal tributaries, 1858 to 1889, inclusive," 377 pages.

"II. Stages of the Mississippi River and of its principal tributaries, except the Ohio, 1860 to 1889," 525 pages.

"III. Stages of water at miscellaneous river stations in California, Oregon, North Carolina, etc., 1875 to 1887, inclusive," 143 pages.

About fifty copies of each have been produced, which have been distributed to the most important stations of this Service, to a few public libraries in the region of the stations, to various engineers engaged in river work, and to the Missouri and Mississippi River Commissions. These volumes show all the river stages observed by the Signal Service up to January 1, 1890, except for places where the stages have already been printed by the Mississippi River Commission.

MONTHLY WEATHER REVIEW.

The Monthly Weather Review, regularly published during the year, has been based on data received from an average of 2,300 observers. The policy initiated by the present Chief Signal Officer of publishing rainfall and temperature data, rendered by every voluntary observer of the Service, has increased the interest in this publication.

In addition to the treatment of current meteorological conditions, there have been added from time to time, as opportunity and space would permit, other meteorological data of great value. In this manner there have been published during the past few years data showing the warmest and coldest months, also the wettest and driest months, covering a period of 20 years and corresponding to the month for which the Review is issued. It is beyond question that the Monthly Weather Review is the most extensive and complete climatic publication extant, and that an examination of its pages will give fuller climatic data for the United States than can be found elsewhere for any equal area on the face of the globe.

INTERNATIONAL WORK OF THE UNITED STATES SIGNAL SERVICE.

In pursuance of a plan of co-operation recommended by the Vienna Meteorological Congress of September, 1873, the work of inaugurating a system of international daily simultaneous meteorological observations was begun by the Chief Signal Officer of the United States Army in the fall of 1873, and by July, 1875, the number and distribution of reports received warranted the publication of the Bulletin of Daily Simultaneous Observations.

The work thus commenced rapidly developed and proved the most gigantic, important, and successful undertaking in the history of meteorology. During thirteen years, 1875 to 1887, inclusive, the land observations of this Service covered the countries of almost the entire Northern Hemisphere and a part of the Southern Hemisphere, reports were received from regular naval and merchant marine vessels of the principal countries of the Northern Hemisphere, and over 150,000 monthly reports, representing upward of 5,000,000 daily simultaneous observations, were received at the Office of the Chief Signal Officer at Washington City.

The co-operation of the United States Navy was begun in 1877, in accordance with a General Order of the Secretary of the Navy, dated December 25, 1876. Observations were received from a number of vessels of the merchant marine during that year, and sub-standard barometers for comparing and correcting ships' barometers were placed in the Maritime Exchange, New York City, and in the Merchants Exchange, San Francisco, Cal. Through the co-operation of the navies of Great Britain, France, Sweden, Italy, and Portugal, and of a number of the great steamship companies, foreign and domestic, and also of the "New York Herald Weather Service," the number of vessels reporting was increased to over 400 by 1882. In this year marine agencies for the collection of vessel reports and the comparison of instruments were established at the principal seaports of the Atlantic coast, and a considerable number of instruments for taking observations were issued to vessels of the United States Navy and to captains of vessels of the merchant marine engaged in the work. As a result of the establishment of the marine agencies the number of vessels furnishing daily simultaneous observations rapidly increased, and at the close of 1887, when this branch of the Service was transferred to the Hydrographic Office, Navy Department, reports were received from nearly 600 vessels.

The number of foreign land stations increased to a total of 459, exclusive of the international polar stations, and the following named countries co-operated during a part or the whole of the period, 1875 to 1887: Algeria, Australia, Austro-Hungary, Belgium, Brazil, Great Britain, Canada, Cape Colony, Chile, China, Costa Rica, Denmark, Egypt, France, Germany, Greece, Hawaiian Islands, India, Italy, Japan, Mauritius, Mexico, The Netherlands, Norway, Russia, Scotland, Spain, Sweden, Switzerland, and Turkey. In addition to the reports furnished by the regular services of the several countries observations were made and forwarded from the islands of the North Atlantic

Ocean, Central America, northern South America, Bering Island, the Aleutian Islands, Alaska, Greenland, and Iceland.

At a meteorological congress held in Rome, Italy, in April, 1879, the work of international observations was encouraged, and the publications of the United States Signal Service were mentioned as models of work to be desired in Europe. By resolutions of the meteorological congresses at Hamburg, in 1879, and at Saint Petersburg, in 1881, details for the establishment of polar stations were arranged, and it was definitely understood that the series of polar observations should begin August 1, 1882. One of the United States expeditions under the command of First Lieutenant A. W. Greely, Fifth Cavalry, Acting Signal Officer and Assistant, sailed from Saint Johns, Newfoundland, July 7, 1881, and reached Lady Franklin Bay August 11, 1881; the other, under the command of First Lieutenant P. H. Ray, Eighth Infantry, Acting Signal Officer, sailed from San Francisco, Cal., July 18, 1881, and arrived at Point Barrow, Alaska, September 8, 1881. International polar stations were also established as follows: By Austro-Hungary, at Jan Mayen; by Denmark, at Godthaab; by Finland at Sodalynka; by France, at Orange Bay, Cape Horn; by Germany at Kingawa Fiord, Cumberland Sound, and at Royal Bay, S. Georgian Islands; by Great Britain and Canada at Fort Rae, British America; by Holland, at Dicksonhaven; by Norway at Bossekop; by Russia at the Lena Delta and Nova Zembla; and by Sweden, at Spitzbergen.

The international publications of the Signal Service, which commenced with the regular issue of the Daily Bulletin of Simultaneous Observations in July, 1875, embody data whose value cannot be overestimated. The network of stations which covered the Northern Hemisphere for a period of years furnished a vast number of reliable observations, the study of which has in no small measure contributed to recent discoveries and advance in meteorology, and in future investigations these observations will be invaluable. In the following table are given the dates upon which the several international publications were commenced and discontinued:

Name of publication.	Date commenced.	Date discontinued.
Daily Bulletin of Simultaneous Observations	July 1, 1875	June 30, 1884.
Monthly Mean Charts of Pressure and Temperature of Northern Hemisphere	January, 1877	December, 1887.
Storm-track Charts of Northern Hemisphere	November, 1877	December, 1887.
Daily International Maps	July 1, 1878	June 30, 1884.
Do	October 1, 1886	December 31, 1887.
*Monthly Summary and Review	July, 1880	December, 1887.
Monthly Summary	January, 1888	June, 1889.

*Prior to 1883 this subject was embodied in the Monthly Weather Review.

With the virtual discontinuance of international work after 1887 the Chief Signal Officer ordered the preparation of a summary of observations showing for each station of the international series the means of ten years' (1878 to 1887, inclusive) observations. This summary was prepared, together with charts showing the monthly mean pressure and prevailing winds over the Northern Hemisphere, under the personal direction of the Chief Signal Officer, by Mr. E. B. Garriott, formerly of the Signal Corps. In the preparation of the charts (Nos. 1–12) the series of international polar observations was used, together with all available observations taken throughout the Northern Hemisphere. Additional charts (Nos. 13–24) were prepared showing the normal pressure changes from month to month over the Northern Hemisphere, and charts showing in figures the number of storm-centers which passed over each square of 5°, and by lines the most frequent tracks of storms in ten years. These publications and charts are based upon an unparalleled series of observations; they represent graphically the labor of meteorologists throughout the civilized world for a period of thirteen years; they are unique in the annals of meteorology; and their proper presentation, rendered impracticable heretofore owing to insufficient funds, is alone needed to class them with the most treasured products of modern meteorology. In completing this work, the Chief Signal Officer has compiled maps showing the mean pressure of the Northern Hemisphere as deduced from ten years' observations under this system, and has charted areas of storm frequency, which valuable contributions are appended to this report.

STATE WEATHER SERVICES.

The report of Major H. H. C. Dunwoody on state weather services co-operating with the Signal Service for the last fiscal year forms Appendix No. 5. This report while setting forth in very considerable detail the history of the state and local weather services now in operation, yet conveys a very inadequate idea of the progress made during the past year, and is likewise deficient in not setting forth the fact that many of these services are state weather services only in name, and that their standing and organization are due to indispensable assistance both in men and material from the Signal Service, without which these services could not have lived for a day.

The Chief Signal Officer pointed out in his last report the evident necessity of drawing a sharp distinction between state services which actually co-operate with the National Service and those which have been practically maintained at the expense of the National Service, using the state name with the expectation of favorable legislative action whereby appropriations would make these services independent of the General Service and give them suitable standing. The Chief Signal Officer has not carried out the line of policy set forth in the last report, that aid should be withdrawn from such services as were unable even to print the accumulated observations for the benefit of the state after having clerical assistance, stationery, office supplies, and even instruments furnished by the National Service. The Chief Signal Officer thought it best to turn over in an unimpaired condition these organizations to the new administration of the Weather Bureau, with the proposed plan of distributing the information for the benefit of the farmers and in the interest of agriculture generally. It did not appear, however, proper to the Chief Signal Officer to longer recognize on the same footing with important services, such as those of New York, Ohio and others, such organizations as those of Alabama, Mississippi, Dakota, etc., which, so far as the Chief Signal Officer knew, had never received a dollar from their own legislatures, but had drawn their subsistence entirely from the appropriations of the National Government.

A state weather service is beyond doubt beneficial to its own community, and forms an important and valuable adjunct to the National Service; but the permanent maintenance, under the misdesignation of state weather services, of organizations wherein the nominal chiefs are practically figureheads, and the managing assistants are employed, designated, and paid by order of the chief of the National Service, to whom they are entirely subject, must be detrimental to the public interest. The General Government does not receive due credit for the work it pays roundly for, and the separate states are put in the false position of receiving a gratuitous organization which is not cared for, or of willing dependence on the Nation for the support of a service maintained and intended solely for their local benefit.

Such organizations are undoubtedly valuable local agents to influence public opinion in matters of legislation and appropriations, but they should be maintained under their true guise as branch offices of the National Service. The reports of his inspection officers on this subject left no doubt as to the advisability of such course, and consequently, as far as lay in his power, the Chief Signal Officer has placed such services as are alluded to on a sound and genuine basis of branch offices.

PACIFIC COAST SERVICE.

The meteorological work pertaining to the Pacific coast has been performed by Lieutenant John P. Finley, at San Francisco, during the year. In carrying out the instructions of the Chief Signal Officer, directing that "every effort will be made to increase the usefulness of the service," Lieutenant Finley has displayed great energy and phenomenal industry, and there is no doubt that his efforts have resulted in largely increasing, with respect to this service, the public interest in that section of the country. The Chief Signal Officer, appreciating the phenomenal growth in late years of the Pacific slope in population, industries, and other material interests, has favored with perhaps undue, and certainly disproportional, liberality the growing wants of the branch office in San Francisco, and besides largely increasing its facilities has extended to that office the map system in vogue throughout the eastern part of the country.

The consolidation of the office of observation with that of the officer in charge, while proving somewhat objectionable to certain interests, and also involving increased expense, yet as a whole has inured to the general benefit of the public.

Owing to the pressure of his duties, and as requested by Lieutenant Finley, he was exempted from the performance of inspection duty which had always devolved on his predecessor, and also from the work of selecting and installing voluntary observers. The work in connection with such observers consequently devolved on Sergeant James A. Barwick, in charge of the Sacramento station, whose long residence in California, supplemented by an intimate knowledge of the meteorological conditions of the state, enabled him to perform this delicate work to the satisfaction of the Chief Signal Officer. In a like manner Sergeant B. S. Pague, in charge of the Portland station, has most proficiently and intelligently performed these duties for the state of Oregon. Sergeants Barwick and Pague have also been charged with the inspection of meteorological stations which the Chief Signal Officer was unable to visit.

STATIONS DIVISION.

The Stations Division has remained during the greater part of the year under the charge of 2d Lieutenant James Mitchell, whose thorough familiarity with the work of that division, conjoined with faithful and intelligent application thereto, has enabled him to render most material assistance to his Bureau Chief. Lieutenant Mitchell's interesting report forms Appendix No. 6.

At the end of the year there were 541 stations in operation, of which 26 were first-order stations making continuous records by means of self-registering instruments, and 117 were second-order stations, making at least two observations daily. Of the first and second order stations over forty are now located in public buildings.

In November, 1890, with the concurrence of the U. S. Commissioner of Fisheries, observations on the temperature of water were discontinued. These observations have been maintained by the Signal Service in the interest of the Fish Commission at various stations on the Atlantic and Pacific coasts for the past eighteen years, and the data now accumulated are sufficient to subserve the present investigations of that important bureau.

EXAMINER'S DIVISION.

Captain Charles E. Kilbourne, Signal Corps, was in charge of this division at the end of the fiscal year. Nearly 31,000 papers relating to money and property accounts were received and disposed of during the year; the work being up to date. More than 21,000 vouchers and accounts-current pertaining to public funds have been transmitted to the accounting officer of the United States Treasury for final settlement, while, under the supervision of Mr. George A. Warren, chief clerk of the division, the high character of the auditing work has been such that not a single paper which has been certified to as correct has been returned by the Treasury Department as defective.

DATA DIVISION.

1st Lieutenant W. A. Glassford, Signal Corps, sets forth in Appendix No. 7 the extremely valuable work done under his direction in the Data Division. Nearly two hundred thousand separate reports have been received, examined, and disposed of during the year. The extraordinary fidelity and accuracy of the enlisted observers are illustrated by the fact that only twenty-four monthly reports have been forwarded late, and that the average number of errors of the 311 observers is but one in 7,411 entries. One-tenth of the entire force in the six months ending December 31, 1890, averaged less than one error a month, that is, in over twenty thousand entries and computations. As the officer in charge of this division says, this accuracy will compare most favorably with the efficiency of any other branch of the public service.

The demand for meteorological data has steadily increased. In addition to the data furnished in office publications, there have been furnished special data in 885 instances, of which 181 have been used as evidence in law cases.

Among other valuable compilations of meteorological data prepared in this division may be mentioned hourly wind travel at principal stations, 1881–1890; excessive precipitation, for month, day, and hour at all stations from establishment to 1890; tabulation of all temperature and rainfall data for Texas; charts of normal temperature for Michigan for each month in the year; charts of normal temperature at 8 a. m. and p. m. for the United States for each decade in the year; charts for the United States of the absolute maximums and minimums in each decade and also for the year; charts of average cloudiness for the United States for each month of the year; charts for each month, showing for the United States the probability of rain as deduced from eighteen years' observations; charts of most frequent wind directions and average hourly velocities at 65 representative stations at 8 a. m. and 8 p. m.; highest and lowest average velocities and hour of occurrence; average number of high winds for each month at the principal stations on the Great Lakes; charts showing for the United States the isobars and isotherms and prevailing wind for each month from January, 1871 to 1873, inclusive; tables indicating diurnal fluctuations of temperature for each hour and month at selected stations; tables showing the diurnal fluctuations of pressure of the atmosphere for each hour of the day and month of the year at selected stations; charts exhibiting the normal temperature of the United States for each month of the year; charts and tables showing all the temperature and rainfall observations for California, Nevada, Utah, Colorado, Arizona, and New Mexico, together with data bearing on the subject of irrigation, sunshine (hours of), and other climatic data bearing on the subject of irrigation; and an index of all meteorological observations ever made in the United States.

It is apparent from this list that an immense amount of climatic data has been put into a permanent and accessible form during the past year. Such a number of publications have been rendered possible only by the systematic arrangement of meteorological data during the past four years, whereby over three hundred and fifty thousand scattered and inaccessible forms have not only been accumulated in part from the Smithsonian Institution and from the Surgeon General's Office, but such reports have been arranged, bound, and indexed, so that any report is instantly accessible. This enormous task has been completed only within the year, and its completion and subsequent compilations have been possible only by Lieutenant Glassford's active and intelligent action, and especially by the assiduous attention and unremitting labor of Mr. A. J. Henry, chief clerk of the Data Division, whose application in this direction has been so great as to cause the Chief Signal Officer at times to urge upon him a relaxation in his unceasing efforts.

Lieutenant Glassford adds to his report a valuable summary of the development and growth of meteorology in the United States. No officer of the Army can read this report without a feeling of pride that the Army of the United States has supplemented its special duty of garrisoning and defending the broad confines of our great country by active and successful efforts to outline the great possibilities of the country at large, by determining with accuracy its favorable climatic characteristics. The labors of the officers of the Medical Department, initiated by Surgeon General Lovell, have not been lost, but must be recognized as the very foundation of climatology in the United States, and in carrying out the recommendation of Captain (afterward General) George G. Meade, his professional brethren in the Corps of Engineers laid the country under obligations for valuable physical data pertaining to the meteorology of the Lake region and the valley of the Mississippi. The work of the Signal Corps can not be spoken of with the same freedom, but the Chief Signal Officer has elsewhere (in his farewell to the men of the Weather Bureau, Appendix No. 8) said: "The Chief Signal Officer knows and fully appreciates the assiduous and invaluable co-operation of the officers of the Army, whose labors in organizing, developing, and operating the meteorological work of this Service will never be adequately stated or generally recognized. It is, however, a matter of record that the meteorological system devised by the officers of the United States Army has proved to be the most successful service in the world, has served as a working model and example for all other nations, while its unique exhibits have elicited unparalleled commendation. The records of the officers who have participated in the work of this Service for any prolonged period show the native ability and special adaptability of Army officers ordered to scientific duty, for which they had not been educated and which more than one accepted with reluctance."

The strenuous efforts of the present Chief Signal Officer to foster and encourage the intelligent and valuable co-operation of the voluntary observers and of other branches of the public service have been continued with notable results. At the establishment of the meteorological branch of the Signal Corps there were no less than four hundred and ninety-two voluntary observers reporting to the Smithsonian Institution, and one hundred and two reports received from post surgeons of the Army. Through lack of encouragement these reports by July, 1880, ten years after the organization of the Weather Service, had decreased one-half, there being two hundred and forty-five voluntary reports, and sixty-five from post hospitals. These conditions remained practically unchanged in July, 1887, despite the creation at very considerable expense to the National Service of no less than 18 so-called state weather services. At that date there were received 295 voluntary reports, 23 from state weather services, and 60 from the Medical Department of the Army.

Four years of earnest, well-directed effort, from 1887 to 1891, have produced astonishing results. The reports from post surgeons have increased from 60 to 112 through the hearty co-operation of the office staff of the Surgeon General, while the growth of the voluntary system has simply been phenomenal, from 318 to 1,916 in four years. The annual decrease of about 4 per cent. for the seventeen years, 1870–1887, has changed to an average annual increase of 150 per cent. In addition to the credit due the record officers in promoting this growth, acknowledgment should also be made to Mr. George A. Warren, through whose well-directed and assiduous efforts the trans-Mississippi region is now covered with numerous voluntary observers, whose geographical distribution is most satisfactory. While the liberally equipped stations of the Signal Corps must always be looked to for exhaustive and varied observations, yet it should be borne in mind that owing to their number, distribution, and situation the country must very largely depend on the voluntary observers for data covering the most important elements of climate, the means and extremes of temperature, the amount and frequency of rainfall, and the occurrence of damaging frosts. This fact was strikingly exemplified in connection with the compilation and publication of the valuable maps showing the average dates of the first and last frosts throughout the United States. If the data from the Signal Service stations had been used as a basis, the results would have been erroneous and misleading. It was necessary to depend entirely on the reports of voluntary observers, located apart from the great towns and cities.

The policy pursued by the present Chief Signal Officer towards voluntary observers has been to recognize as far as possible the important contributions to knowledge made by these devoted and self sacrificing students of science. Except as regards pay, which Congress declined to grant, these observers have been placed on the same footing as the regular paid observers. The monthly forms have been regularly acknowledged and carefully examined for errors and inaccuracies. Defects or errors have been courteously brought to the attention of the observer, with suitable suggestions for the future, while special reports of value have been commended and encouraged. The substance of all voluntary data has been published regularly, with official recognition of the observer who has contributed. In special cases of long or important records of temperature or rainfall complete tables have been published.

The propriety of reciprocity on the part of the United States towards the sacrificing voluntary observer has been obvious to the Chief Signal Officer, who has regularly furnished, as the only possible means of acknowledging their services, the regular publications of the Signal Corps and such other publications as he has been able to obtain for them. Experience, however, has shown the necessity of caution in the issue of instruments to persons offering to make voluntary observations, since many apply to Signal Service observers for instruments and then utterly fail to render reports.

INSTRUMENT DIVISION.

The control and maintenance of instruments and methods to insure accuracy and correctness of observations made therefrom has remained in charge of Assistant Professor Charles F. Marvin, whose valuable report forms Appendix No. 10.

During the year the self-registering instruments at the central office have been entirely rearranged, new methods of testing instruments and of securing uniform results devised, while work of investigation of the highest scientific importance to the Weather Bureau has progressed to satisfactory and important conclusions.

The advantages of a card system for quick and easy reference has led to its application to a complete record of the issue and distribution of the very large number of meteorological instruments of various kinds now in the hands of the numerous corps of observers of this Service. Each instrument of a kind has its individual number, and is represented by duplicate cards giving salient characteristics of the instrument and blank space for a brief statement as to its present location, date of issue, etc. One series of cards, the index series, is classified by instruments and arranged in numerical sequence. Each card shows the place at which the individual instrument may be found. The duplicate cards are classified by stations and show in every instance just what instruments are at any particular station, how long they have been there, etc. Changes in the location of instruments are always accompanied by corresponding changes in the cards.

The prime importance and necessity in a meteorological service such as this of the United States of a high and uniform standard of excellence in the instrumental equipment of its stations is doubtless second only to the necessity for a skilled and uniformly able corps of observers. During the early part of the growth of the Service, owing to its large stretch of territory and numerous stations, it was not possible, except by very great expenditure, to at once equip so extended a Service with more than the most essential instruments and accessories. Within the past few years, however, the standard of equipment has been very greatly improved, not only as regards the issue of many new and improved instruments and appliances, but as well by the continued efforts to bring about the greatest uniformity both in the instruments themselves and their mounting and exposure. Every effort has been made to raise stations from second to first order in such numbers as to insure for future study and reference accurate and continuous meteorological data at a sufficient number of points to clearly outline the general climatic conditions of the country.

A preliminary trial of the feasibility of introducing certain new forms of instruments for recording temperature and pressure, wind-direction and rainfall, was made in 1888–'89. This was in general so satisfactory that, starting with the issue in 1888 of forty thermographs and five barographs, the Service has now in operation eighty-five thermographs, fifty-three barographs, twenty sunshine recorders, thirty-five triple registers (wind-direction and velocity and rainfall), twenty-two double registers (wind-direction and velocity), and forty-one self-recording rain gauges.

The more detailed history of the introduction of these instruments, and their distribution, is given in the tables and report of the Instrument Division.

While the International Meteorological Congress has in its various meetings urged the importance of first-order stations, yet that body has not clearly defined the kind and minimum number of self-registering instruments necessary to constitute the equipment of a first-order station. In some European services, stations recording only the velocity of the wind are rated as of the first order; this standard is undoubtedly too low. All second-order stations of this Service have recorded wind velocity for many years, and might by the above standard be classified as of the first order, whereas the greater number of the so-called first-order stations of the United States Signal Service are, it is believed, equaled only by the best-equipped observatories of the European services.

On this question it may be said that, by general understanding, stations of the first order should at least comprise all those where the more important meteorological phenomena are continuously recorded by self-registering instruments.

The following self-registering instruments are in use in the Signal

Service—For recording temperature: maximum and minimum thermometers, wherefrom the highest and lowest temperature of the air are recorded (in use at all stations); thermographs, whereby are registered continuously the temperature of the air (in certain special thermographs, these registrations are effected by means of electricity at a considerable distance from the exposed thermometer). Atmospheric pressure: barographs, wherefrom are recorded continuous curves of the pressure. Wind: anemometer registers, whereon is registered by separately recorded miles the velocity of the wind; anemoscopic registers, whereby the direction of the wind is recorded either continuously for every mile of wind, or preferably for every five minutes of time. Rainfall: instruments whereby the rapidity of precipitation is shown in cases where the amount of any one hour exceeds one-twentieth of an inch (on most Signal Service registers the rainfall is recorded on the same sheet with the direction and velocity of the wind). Sunshine registers, whereby the amount of sunshine is simultaneously recorded by means of photography.

It is thus possible for a station to have two self-recording themometers, a thermograph, a barograph, an anemometer register, a wind-direction register, a sunshine recorder, and a register of the rapidity of the rainfall. Neither local interests nor the general work of the Service will ever require that these eight self-recording instruments should be at every station in the country, but rather that they should be distributed in different sections of the country, having reference to the importance of the respective meteorological phenomena which they record.

In making his office classification, the Chief Signal Officer considers that any station having out of these eight possible instruments five, of which one is either a barograph or a thermograph, should be considered a station of the first order. Under such construction there were 51 first-class meteorological stations in operation in the United States on June 30, 1891.

EXPERIMENTAL STUDIES.

In addition to the important routine duties devolving on him, Professor Marvin has applied himself with great zeal, and with even greater skill and ability, to experimental studies which have an important bearing on meteorological methods and instruments. The Chief Signal Officer believes that Professor Marvin in his investigations of wind pressure has exhibited such skill as an investigator as especially redounds to the credit of the Bureau with which he has rendered such efficient service.

The investigations commenced over a year ago upon the pressure of aqueous vapor at low temperatures, and referred to in the last annual report, page 33, were postponed during the summer while anemometer and wind pressure experiments were made by Professor Marvin at

Mount Washington. When resumed later in the year, his first efforts were directed towards devising means and apparatus for producing and maintaining the desired artificial low temperatures. Previous experiments with such refrigerating liquids as carbonic acid or nitrous oxide had shown them to be exceedingly troublesome, of uncertain effect, and expensive, while liquid anhydrous ammonia, by the method then in use for the comparison of thermometers, could not be made to produce a temperature lower than —25° Fahr.

The compact, simple, and highly efficient ammonia apparatus devised by Professor Marvin and fully described in the inclosure to his report, Appendix No. 10, is of itself a valuable physical appliance, and will doubtless prove useful in many physical investigations. By its use, charged with a few pounds of anhydrous ammonia, and aided only by a small hand pump, a large bath of alcohol can be lowered in temperature to 80° or more below zero, Fahrenheit, with the temperature under perfect control at all times. The apparatus is now regularly used at this office in the comparison of thermometers at low temperatures.

Pending the development of the low-temperature apparatus and its manufacture, Professor Marvin was also engaged upon the development and preparation of a normal barometer. While the Chief Signal Officer has long recognized the importance of establishing and preserving the Signal Service standard of barometric pressure, by means of instruments of superior construction and unquestioned accuracy, yet action in this respect has scarcely been practicable heretofore, owing to imperative needs in other directions. So much has already been done by eminent scientists towards the perfection of normal barometers, that these instruments are now constructed most satisfactorily, leaving little opportunity for mechanical improvement.

The form arranged by Professor Marvin, as described and figured in the inclosure to his report, Appendix No. 10, seeks to combine in the Signal Service standard the excellent points of all the best normals, with a due regard for convenience in use and the most favorable conditions possible for exhaustion and filling. The elaborate care, extending to the minutest details, observed in the preparation and filling of the barometer tube, is believed to have produced very superior results. The progress of the construction of the normal barometer was suspended in order to resume and complete the observations upon vapor pressures, and was subsequently further interrupted by the reconstruction of defective and insecure piers for the instruments, and also by the laying of tile flooring in the standard and laboratory room. Only a few comparisons of the office standard barometer (Adie No. 1,526) and the normal have thus far been made. The normal in this case read lower by 1.70^{mm} than No. 1,526. The probable cause of this difference has not yet been fully ascertained or investigated.

Professor Marvin's report upon the maximum pressure of the aqueous vapor at low temperatures (Appendix No. 10, inclosure) gives in detail the results of this extremely difficult investigation. Table III presents in condensed form the final results of all the observations below the freezing point, and, by the way of comparison, gives the difference between his values and those of Broch's tables and also those of Regnault's direct observations. The agreement between these latter over the less extended range of temperature of Regnault's experiments is, in the main, so much closer than that between Broch's table and the observations from which it is computed, as to not only establish the accuracy of the observations, but to show the necessity of a new tabular reduction.

The somewhat novel method of interpolation, selected by Professor Marvin when the usual mathematical formulas were found to be so inadequate, must commend itself to all for the accuracy and satisfactory manner in which the table and the experiments harmonize.

Only a few observations of vapor pressure at temperatures above 32° Fahr. have been made by Professor Marvin, but these also systematically differ from Regnault. During the coming year it is hoped that under the auspices of Professor Harrington, Chief of the Weather Bureau, this important work will be continued, and additional examination made in order to determine the real extent and nature of this difference at higher temperatures than have yet been employed.

The peculiar phenomena observed by Professor Marvin in respect to the abnormal freezing of water, and corresponding differences in vapor pressures, must have an important bearing upon the molecular theories of gases and vapors.

Prof. Cleveland Abbe, the senior civilian assistant, was engaged for about seven months in the application to special cases of his preparatory studies for forecasting storms, but when relieved from this duty the work of investigation was not in such condition as to enable it to be practically applied, so that its value is as yet undetermined.

In order to facilitate the extension and application of the work of the Weather Bureau to agriculture, Professor Abbe, for the last four months of the fiscal year, was directed to apply his entire energies and attention to a compilation of the most important results arising from investigations in meteorology relative to animal and vegetable life. His report, under the title of "The Relation between Climate and Crops," is a summary of the present state of knowledge on this important topic; however, as the report did not have reference to the current work of the War Department, it was transmitted at the end of June to the Honorable Secretary of Agriculture, with the recommendation that it be published by that Department.

Professor Hazen made a brief but interesting report on "Methods of Weather Forecasting," Appendix 3, part II.

LIBRARY.

Under the intelligent supervision and zealous application of Mr. Oliver L. Fassig, whose report forms Appendix No. 11, the professional library of the Signal Service has been finally brought into such condition that the valuable books which comprise it are readily accessible to all interested. The policy has been continued of purchasing strictly professional books, and, owing to the lack of sufficient funds, only those are purchased which cannot be obtained by exchange, or are not easily accessible in other professional libraries of Washington. While the Signal Service library does not contain as many meteorological publications as the British Museum, the Bibliotheque Nationale of Paris, or the Library of Congress, yet apart from these three national libraries there is no other which contains as many publications on meteorology as the library of this office. The very liberal contingent fund for the next fiscal year insures suitable additions. It is safe to state that even now very nearly one-half of all published meteorological books and memoirs are to be found in it, and the system of indexing is so complete and satisfactory that the scientific data contained in these volumes are readily available.

The great interest in his library duties shown by Mr. Fassig has been exemplified not only by his work during office hours, but by the devotion of his private time to the matter, and by his sacrifice of a portion of his vacation in order to attend at his own expense a meeting of the American Librarians, an expense which should have devolved upon this office had the sub-appropriation permitted.

The Chief Signal Officer has endeavored to extend the usefulness of the library beyond the force employed in the central bureau, and to this end has not only issued the professional books to the regular observers of the Signal Service wherever stationed, but has also loaned them under proper restrictions to all meteorologists or other interested persons who have made application therefor. It is gratifying to know that not a single volume has been lost through this liberal extension of the library privilege.

In addition to the usual office work Mr. Fassig has continued the General Bibliography of Meteorology, supplementing it by titles of meteorological works and articles which have appeared within the past eight years. Over sixty thousand (60,000) titles are contained in the present card catalogues, arranged in a large number of classes and perfected by a complete authors index.

The Chief Signal Officer has continued his efforts to put this bibliography in such shape that it may be avaliable to students of the great universities and also by leading meteorological bureaus of the world. As it became necessary to expend some three thousand dollars of the printing fund in binding accumulated meteorological data pertaining to the Service, it was impossible to apply any part of the regular printing appropriation to the publication of this bibliography, but no such demand will fall on the Bureau during the coming year, and as the printing appropriation has been practically increased a thousand dollars by the separation of the civil and military work, it is hoped that this bibliography will appear in printed form during the next few years, and thus accomplish a duty to co-operating scientists. Even under adverse conditions the Chief Signal Officer has been able to reproduce a considerable number of copies by means of the typewriter and the adoption of duplicating methods devised by the clerical force in the office. By these and similar means the following four parts have been reproduced and distributed to co-operating observers, chiefs of important weather bureaus, and to the most important libraries of the United States:

Part I—Temperature; 4,400 titles. Part II—Moisture; 5,500 titles. Part III—Wind; 2,000 titles. Part IV—Storms; 4,300 titles.

These four parts cover subjects which are most generally in demand, and it is gratifying to note that about one-fourth of all the titles in the general bibliography have been thus duplicated and rendered available for general use.

The special bibliographical report of Mr. Fassig indicates the intellectual activity of the officials of the Signal Service in the past.

SUPPLY AND MISCELLANEOUS DIVISION.

The disbursements for purchases and for services rendered in connection with the Signal Service have been most faithfully and efficiently made by Captain Robert Craig, A. Q. M., whose report forms Appendix No. 12. The intimate knowledge of the details of this Service possessed by Captain Craig has tended to decrease the heavy burden of care and responsibility which would have inevitably devolved upon the Chief Signal Officer had the duty fallen to a disbursing officer unfamiliar with the special work of the Service.

In Captain Craig's report will be found the list of contracts made during the fiscal year, submitted in accordance with the act of Congress approved April 21, 1808; also the conditions of the appropriations, with expenditures, balances, and probable demands, as required by the act of Congress approved May 20, 1820.

There have been deposited in the Treasury, as required by law, $31.25 received from the sale of 37 miles of abandoned telegraph lines; the sum of $326.77 on account of condemned property sold at public auction; and also the sum of $359.86 received from the sales of publications, under the act approved May 30, 1874 (Section 227, Revised Statutes), which latter sum accrued to the credit of the appropriation for "Observation and report of storms."

The money accounts of the Disbursing Officer have been once inspected, and the balance verified by an officer of the Inspector General's Department, during the fiscal year.

The satisfactory state and prompt settlement of the money affairs of this Service is illustrated by the fact that out of 9,638 accounts, growing out of the various appropriations during the year, there remained on June 30, 1891, no accounts unsettled in the office of the Chief Signal Officer, excluding forty-one bills of the Western Union Telegraph Company, which are in dispute as regards the rates fixed by the Postmaster-General.

This unusual condition of an office, in which the creditors of the Government had their accounts adjusted and settled immediately on receipt, was due to the assiduous application and business-like methods of Captain Craig, supplemented by the detailed knowledge, extraordinary energy, and close application of Mr. William R. Bushby, his chief clerk.

On July 1, 1889, as stated in my annual report for the fiscal year ending June 30, 1890, page 28, an important reform went into operation, under a provision in the appropriation act approved March 2, 1889, whereby it was directed that the pay and allowances of the enlisted men of the Signal Corps be disbursed in one check by the Disbursing Officer of this Bureau. This legislation corrected the business evil which for so many years prevailed, whereby each man in the Signal Corps received his monthly pay in three different checks based on three sets of different vouchers and paid by three different officers and at different times of the month, a method which enormously increased the labor and records, and often delayed the final payments for weeks after the month ended. The new method reduces the labor and records by 80 per cent. and insures to all subordinates prompt and immediate payment, a consideration of especial importance to men of small salaries. The new system has continued to work to the utmost satisfaction, and the monthly compensation of the enlisted men has been mailed to them on the very day when the pay was due. Payments to all men in the Signal Corps, whether serving in Arizona or New York, are made by check, and, as indicating the certainty of the method, it should be mentioned that in the past year 3,540 checks have been mailed to men of the Corps, and only 4 checks miscarried.

The introduction of the card system of letters received referred to in my last annual report, page 28, has been continued during the past year, and with good results.

ESTIMATES.

On September 15, 1890, estimates for appropriations for the fiscal year ending June 30, 1892, were submitted to the Honorable Secretary of War, but subsequent legislation, the act of Congress to increase the efficiency and reduce the expenses of the Signal Corps of the Army, and to transfer the Weather Service to the Department of Agriculture, approved on October 1, 1890, required the revision of the estimates submitted. In Captain Robert Craig's report is set forth, in detail, the reduction during the past six years in the appropriations for the maintenance of the Service in all its branches. The aggregate amount of money appropriated in both the regular and deficiency bills, including all accounts and claims allowed by the accounting officers of the

Treasury Department, is as follows: Fiscal year ending June 30, 1886, $939,705.72; 1887, $913,981.23; 1888, $913,670.27; 1889, $856,995.38; 1890, $821,105.21; 1891, $815,655.19.

This shows a total reduction in annual expenditures of $174,050.53 in the past five years. Among the larger items of savings may be noted, $50,000 through the reorganization of the business methods of the central office, thus making possible a corresponding reduction in the force employed; about $40,000 through the invention of the Chief Signal Officer personally of a new telegraphic weather code, and over $18,000 in transportation. It should also be set forth that a reduction of $7,500 in rent occurred through the purchase of the present building and grounds under an act of Congress, which eliminated the item of rent for future years.

The separation of the two branches of the Signal Service resulted in the transfer of the estimates for the strictly military establishment to the Army appropriation bill, which, since 1888, has been charged with the military expenses of the Signal Corps of the Army, as follows: Pay and allowances for officers of the Signal Corps, and the authorized enlisted force of 50 sergeants, $92,500; signal and telegraphic expenses, $22,500; officers salaries, $5,700; public printing, $1,500; office stationery, $275; contingent expenses, $575. Aggregating $125,050. In addition, it became necessary to rent for $2,000 quarters for the Signal Corps sufficient to accommodate the office force and a general supply depot.

At the request of the Honorable Secretary of Agriculture the Chief Signal Officer prepared the estimates wherein was incorporated the present civilian organization of the Weather Bureau. These estimates commended themselves to the Secretary of Agriculture, and were approved by him, with certain additional sums intended to carry out the act of Congress approved October 1, 1890, for the extension of the Service in the interest of agriculture. They also commended themselves to the Appropriation Committees of Congress, and, with a very slight reduction, were voted in the appropriation bill for the coming fiscal year. These estimates can be found in detail in the "Book of Estimates," and the resulting sums voted appear in the "Digest of Appropriations."

An increase of over 18 per cent. over the Weather Bureau appropriations for the present fiscal year was obtained, there being an actual increase of over 9 per cent. in the appropriation bill itself, while there was a gain in the Weather Bureau of about 10 per cent. more by the transfer to the Army appropriation bill of the charges for the support and maintenance of the Signal Corps, military telegraph lines, and the office force of the Chief Signal Officer. This marked liberality of Congress insures the future extension of the Weather Bureau to new and broader fields of usefulness.

While the transfer of the Weather Bureau to the Department of

Agriculture took place on July 1, 1891, yet it appears proper to touch on this subject in this report rather than to delay a year. As the delegated representative of the Secretary of War, the Chief Signal Officer transferred the Weather Bureau to the Secretary of Agriculture and his subordinate, the Chief of the Weather Bureau, on the morning of July 1st. At that time the entire force had been paid to include June 30, and all accounts and bills in the office had been adjusted and paid so that there were no arrears of public business of any character.

It is a source of gratification to the Chief Signal Officer that his methods of business were such that to this time, more than three months after the transfer, they are continued without modification of any importance. Three officers of the Army remain on duty, and no change has been made in the forecasting force or methods. It is interesting that as the first predicting official (Professor Abbe) detailed by the Chief Signal Officer was a civilian, so the first predicting official formally detailed by the Chief of the Weather Bureau was an Army officer, Lieutenant Glassford.

A. W. GREELY,
Chief Signal Officer.

LIST OF APPENDIXES ACCOMPANYING THE REPORT OF THE CHIEF SIGNAL OFFICER OF THE ARMY FOR THE YEAR ENDING JUNE 30, 1891.

APPENDIXES COVERING REPORTS OF THE FOLLOWING-NAMED SUBJECTS.

1.—Military signaling.
2.—Telegraph lines.
3.—Verifications.
4.—Cold waves.
5.—Rivers and floods.
6.—State weather services.
7.—Meteorological stations.
8.—Meteorological data.
9.—Farewell order of the Chief Signal Officer.
10.—Instruments.
11.—Library.
12.—Supply and miscellaneous.
13.—Changes in signal-service stations and annual meteorological summaries for 1890.
14.—Temperature data from regular and voluntary observers.
15.—Monthly and annual precipitation data for 1890, from regular and voluntary observers.
16.—Dates of the first and last killing frosts of the season 1890-'91.
17.—Twenty-five international charts and discussion thereof.

APPENDIX I.

REPORT OF THE OFFICER IN CHARGE OF THE DIVISION OF MILITARY SIGNALING.

SIGNAL OFFICE, WAR DEPARTMENT,
Washington, D. C., July 31, 1891.

SIR: I have the honor to submit the following report of affairs pertaining to the division of military signaling for the year ending June 30, 1891.

The record shows that more attention has been given to signaling in the Army the past year than in any other like period of time since the war. Two hundred and nineteen officers and 2,607 enlisted men have received instruction, of whom 146 and 909, respectively, are reported proficient in the use of the ordinary equipments.

The following statement sets forth in detail the number instructed in each regiment:

INSTRUCTION AND PRACTICE IN SIGNALING AT MILITARY POSTS FOR THE YEAR 1890–'91.

	Instructed.		Reported proficient.	
	Officers.	Enlisted men.	Officers.	Enlisted men.
First Cavalry	5	60	4	16
Second Cavalry	1	73	....	28
Third Cavalry	9	43	4	13
Fourth Cavalry	9	55	3	18
Fifth Cavalry	6	137	4	48
Sixth Cavalry	1	12	1	5
Seventh Cavalry	7	148	6	87
Eighth Cavalry	7	48	4	11
Ninth Cavalry	4	61	2	31
Tenth Cavalry	....	59	....	18
	49	696	28	275
First Artillery	15	120	11	54
Second Artillery	11	61	4	10
Third Artillery	13	62	13	23
Fourth Artillery	9	97	6	18
Fifth Artillery	14	239	9	76
	62	579	43	181
First Infantry	....	92	....	16
Second Infantry	5	17	4	....
Third Infantry	9	55	6	25
Fourth Infantry	....	45	....	2
Fifth Infantry	2	38	1	15
Sixth Infantry	4	78	3	34
Seventh Infantry	6	45	4	21
Eighth Infantry	2	33	1	11
Ninth Infantry	....	27	....	9
Tenth Infantry	1	32	....	9
Eleventh Infantry	5	53	5	16

INSTRUCTION AND PRACTICE IN SIGNALING AT MILITARY POSTS FOR THE YEAR 1890-'91—Continued.

	Instructed.		Reported proficient.	
	Officers.	Enlisted men.	Officers.	Enlisted men.
Twelfth Infantry	5	46	2	20
Thirteenth Infantry	8	143	5	60
Fourteenth Infantry	9	36	......	5
Fifteenth Infantry	4	69	4	15
Sixteenth Infantry	3	32	3	29
Seventeenth Infantry	2	72	1	52
Eighteenth Infantry	3	31	3	1
Nineteenth Infantry	8	96	5	39
Twentieth Infantry	8	46	7	26
Twenty-first Infantry	......	29	......	12
Twenty-second Infantry	10	73	10	1
Twenty-third Infantry	4	55	3	19
Twenty-fourth Infantry	4	35	3	15
Twenty-fifth Infantry	6	49	5	1
	108	1,332	75	453
Total	219	2,607	146	909

NUMBER OF MEN INSTRUCTED SHOWN BY DEPARTMENTS.

Arizona	213
California	296
Columbia	108
Dakota	398
East	657
Missouri	542
Platte	226
Texas	167
Total	2,607

PER CENT OF ENLISTED MEN INSTRUCTED.

Department of—	
Arizona	11.2
California	26.9
Columbia	8.3
Dakota	12.1
East	16.6
Missouri	19.4
Platte	7.5
Texas	9.4
Average	13.9

The chief value of this exhibit lies in its substantiation of the opinion often expressed that the Army, if it will, can easily attend to its own signaling. Undoubtedly it can if necessity require, and under present regulations a large body will always be available from which to select material in emergency. But it will not do to go too far in dependence upon men trained at arms to give their best service to signaling at the moment of actual engagement. During the Indian operations in Dakota the past winter an officer of the corps was detached from his post for field duty as signal officer. The exigencies were such that a signal detachment was provided from the mounted troops at the front, and rendered good service in maintaining communication between the detached commands, and was reported as having given valuable assistance in forwarding supplies, but when the test came in the affair at the Mission the men of this detachment, leaving their signaling equipments behind, joined their troops and took part with them in action, in which one of the detachment was killed and one wounded. It is evident that men trained and expert in signaling must alone be depended upon for maintaining communication during action; that is, the Signal Corps must depend upon itself. Now that the burden of the Weather Bureau has been taken from it, and a suitable organization given to the corps, there is no chance for doubt as to the excellence of the signal work which the future will show. What it has done, and will again be capable of doing, and even excelling, may be inferred from the following extracts from communications of prominent commanders.

Brig. Gen. Wesley Merritt: "I have noticed with considerable interest, while on active service with the cavalry, the working of the officers of the Signal Corps with whom I have been thrown. The means they now have of communicating with friends and of detecting and reporting as to the enemy, coupled with the energy and enterprise of all the officers of the Signal Corps with whom I have been thrown, have made the organization invaluable to the cavalry service. Especially is this so when, as is often the case, we are separated by miles from the general headquarters with no other safe or rapid means of communication."

Brig. Gen. John Buford: "I have taken occasion to notice the practical working of the Signal Corps, U. S. Army, in the field and regard it as a valuable auxiliary to an army. With the aid of their powerful glasses, acting as both scouts and observers, the officers who have acted with me have rendered invaluable service when no other means could have availed."

Brig. Gen. George A. Custer: "Since I have become acquainted with the Signal Corps of this army, the information of the enemy obtained through its officers, and the rapid method they have of transmitting intelligence by flag signals, has convinced me of the great value of this branch of the service during military operations in the field. An army can have no better outpost from which to watch the movements of an enemy than a signal station and with a practiced officer at such a position no force can move without being detected."

Brig. Gen. Judson Kilpatrick: "The battle of Brownsboro was fought and won by the aid of signals; every move of the enemy was seen by the signal officers occupying an elevated position, and quickly transmitted."

Maj. Gen. Alfred Pleasonton: "In this corps there is a signal officer with each division, and the frequent opportunities in which their services have been brought into requisition, in the transmission of important intelligence, when operating far in advance or on the flanks of the army, away from a common center and in places where the ordinary means of telegraphing could not possibly be applied, convince me of their very great utility, at least with this army."

Maj. Gen. George Sykes: "The Signal Corps has been of great use to the army. During the battle of Gettysburg its services were highly important to me. At Malvern, Chancellorsville, and other places, the intelligence given and gained by it, greatly affected the operation of the army."

Rear-Admiral S. F. Dupont: "It had been my intention before leaving Port Royal to express to you, through the commanding general, my high appreciation of the labors of the Army Signal Corps in the Department of the South, so far as they related to the naval force under my command. The system itself elicited the highest commendation, and its adoption, ashore and afloat, became every day more striking and valuable. I was first impressed with its superiority on our passage down with the 'Expeditionary Corps,' for it enabled me to keep up a ready communication with the army transports, and I am convinced that, but for directions which I gave to several vessels, and which I could have transmitted only by these signals, on the eve of the dangerous gale we encountered, we should have experienced serious disaster from collision."

Maj. Gen. Winfield Scott Hancock: "At the Po River, on the 10th of May, part of my corps was engaged with the enemy on the south side, and communication with the main army, at a distance of some 2 miles, was kept up by signals. I remember ordering up some artillery at a critical period, by signal, to cover the recrossing of the division engaged on the south side. Aside from the constant duty performed by these officers at posts of observation, they were serviceable at the Toloptomy, June 3, in observing the effect and directing the fire of our artillery, and occupied a very exposed position. At the crossing of the James River they were also used as a means of communication. On both occasions when this corps was operating from Deep Bottom, on the north side of the James, the signal officers were extremely useful in directing the fire of the gunboats and in observing the enemy's movements."

Maj. Gen. George B. McClellan: "The Signal Corps under Maj. Myer rendered, during the operations at Antietam as well as South Mountain, and during the whole movements of the Army, efficient and valuable service. Indeed, by the services here, as on other fields elsewhere, this corps has gallantly earned its title to an independent and permanent organization. * * * In front of Washington, on the lower Potomac, and at any point within our lines not reached by the military telegraph, the great usefulness of this system of signals was made manifest. But it was not until after the arrival of the army upon the peninsula, and during the siege and battles of that and the Maryland campaign, that the great benefits to be derived from it, on the field and under fire, were fully appreciated. There was scarcely an action or skirmish in which the Signal Corps did not render important services. Often under heavy fire of artillery, and not infrequently while exposed to the musketry, the officers and men of this corps gave information of the movement of the enemy, and transmitted directions for the evolution of troops."

Maj. Gen. George H. Thomas: "During the pursuit of Bragg in Kentucky, in the fall of 1862, several opportunities were offered for testing the usefulness of the signal system, all of which not only established its practicability, but its usefulness. The corps was organized in the fall of 1862, at Nashville, and commenced operations with more system than at any previous time. During the battle of Stone River the officers of the corps with me were very efficient in conveying messages by flag. After the battle, and while the enemy were encamped near Murfreesboro, an opportunity was offered for thoroughly testing the usefulness of the system, and resulted in the conclusion that a well appointed signal corps was one of the essential organizations of a well appointed army. Stations were established at Murfreesboro, Readyville, Triune, Lavergne, and Franklin. Triune and Lavergne were both about 12 miles from Murfreesboro; Readyville about 8 and Franklin about 14 miles from Triune. Messages could be transmitted from one station to the other with the greatest celerity, and frequently communication was held between headquarters at Murfreesboro and the above-named stations by signals when there was no other means of communication but by sending a force to protect the messenger. When Van Dorn attacked Franklin, reënforcements were directed how to move to give the greatest assistance to the garrison by message from Murfreesboro to Triune by signal. Repeated instances of its great usefulness occurred at Murfreesboro; also on the advance towards Bridgeport, particularly at Hoover's Gap during the engagement at that place. Before crossing the Tennessee daily information was received at headquarters of the operations of the different detachments of the army on the north side of the river and in the direction of Chattanooga through the signal lines.

"The Corps was also equally useful after the army crossed the Tennessee, and until the concentration at this place (Chattanooga) after the battle of Chickamauga. Since our arrival here the value of the system has time and again been more closely demonstrated by the great amount of information of the movements of the enemy obtained and transmitted to headquarters by its aid, which could not have possibly been obtained by any other means in time to have been of use.

"During the recent battles here the officers of the corps rendered most valuable services by observing and signaling information of every movement of the enemy within the range of their telescopes."

Gen. W. T. Sherman: "When the enemy had cut our wires and actually made a lodgment on our railroad about Big Shanty, the signal officers on Vining's Hill, Kenesaw, and Alatoona sent my orders to General Corse, at Rome, whereby General Corse was enabled to reach Alatoona just in time to defend it. Had it not been for the services of this corps on that occasion I am satisfied we should have lost the garrison at Alatoona and a most valuable depository of provisions there, which was worth to us and the country more than the aggregate expense of the whole Signal Corps for one year."

The national guard of many States have also shown interest in signaling matters during the year, the number of communications received containing requests for information and material having greatly increased.

In view of the fact that army signal equipments and stores are made after patterns in the Signal Office and as a rule specifications for such articles are not accessible to outside persons, and as the articles themselves when ordered are made by some contractor having special facilities for doing the work, and are manufactured in large quantities, the prices paid for such articles by this service being generally much lower than those at which they can be bought by private parties, and as it is proper that the national guard of the country should have the benefit of the contract prices at which the Government secures such articles, the following bill was introduced during the past session of Congress:

"*Provided*, That from signal stores herein appropriated for, the Chief Signal Officer, on proper application in writing by the adjutant-general of any State, may sell to such militia at contract prices such signal equipments and stores, field glasses, telescopes, heliographs, and other apparatus as may be necessary for instruction in military signaling, the money received therefor, which shall revert to the appropriation for the current year in which the sale may be made, must be duly accounted for as other public money, and may be used in the purchase of like articles to replace those so sold."

Unfortunately the bill failed of passage, doubtless from lack of time for consideration, and it is still impracticable to fill the requisitions of the militia; it is, however, practicable to supply material to the national guard encampments by the detail of an officer of the Army, who shall be responsible for the equipments and shall instruct in their use.

At the academies and colleges to which Army officers have been assigned as military instructors, requests for equipments have greatly increased; the issues, however, except in a few cases, have been confined to the simple flag and torch equipment.

Two hundred and seventy *requisitions* from military posts have been received and acted upon during the year, and supplies furnished at an expense of $7,089.39. As a rule it has been necessary, due to insufficiency of stock and appropriation, to clip and pare, and the issues represent but a fraction of the demand.

The supplies on hand are very meager and it is essential that still further contractions be made in issues to provide for contingencies, or that the appropriation for equipment be considerably increased. A complete outfit for the signal detachment and troops in the field in the vicinity of Pine Ridge Agency could not be provided from the supplies in the Department of Dakota, or from stock at this office, and it was necessary to transfer instruments and material from another department. As a means of remedying such a state of affairs in the future, and that the troops may at all times be provided, it has been recommended that each company, troop, and battery be furnished with a complete set of equipments, which should pertain to the organization alone and be carried as company property, as in the case of ordnance stores. Such desirable arrangement, however, must necessarily be deferred until appropriations are more ample, as it implies a very great increase of instruments and material over the present post supplies.

During the year the abandonment of several posts and the concentration of troops at others has eased up somewhat by making stores at the abandoned points available for transfer elsewhere.

Signaling with the *heliograph* is so attractive a method of communication, the range is so great, and the results, when conditions are favorable, so clear and decided that general interest has been developed in the use of the instrument and, as noted in previous reports, the most astonishing results have been obtained by our troops.

While the composition of the service instrument in material respects is satisfactory, the se vere tests to which it has been put have shown the need for changes in minor particulars and for better workmanship than has yet been secured under the contract system. To this end the coöperation of the Ordnance Department has been sought and through the courtesy of its chief the next supply will be manufactured under the supervision of the expert master mechanic at the Frankford Arsenal.

The legs of the new instrument will be more firmly assembled, with a better bond between the wood and metal. A more substantial bearing will be given the mirrors. The cones will be more delicately adjusted to the sockets. Greater contact will be given between the base of the mirror frame and the top of the bar. A new method of clamping the bar has been devised, and also of giving it a slow motion in azimuth. A tangent screw will be placed at both ends of the mirror bar for revolving mirrors about vertical axes.

The sighting rod will be attached to the bar so that when raised the disk will stand square to the direction of the mirror bar prolonged, and a tangent screw will be added to the sighting rod so that vertical motion to the disk may be delicately given. The screens will be divided into leaves and operated by a key similar to that used on telegraph instruments. The mirror bar will be somewhat enlarged, but with extra metal judiciously removed to diminish the weight. Aluminium will be used for the metal parts where practicable if tests show the metal to be suitable. The mirrors can not be supplied at the arsenal; contracts for these, to satisfy the most rigid requirements, have been given elsewhere. There is no doubt that the instrument now making will excel in workmanship and performance.

The *field telephone kit* is so expensive an equipment that it has been impracticable to go ahead with the manufacture for issue. The model set is in perfect order and very satisfactory It was used at the Mount Gretna encampment of the Pennsylvania militia and has been connected up a few times about the office to show how well it works, but no opportunity has offered to give it a severe practical field test. Its value for use in action by the Signal Corps is undoubted, and it does not seem unlikely that it would form an important article of the equipment if issued to companies, troops, and batteries. A special appropriation for the manufacture of a number to test the matter is very much to be desired.

It has been thought possible to utilize the old telephones possessed by the service for use as extemporized field equipments by assembling the telephone and transmitter in one piece, but further examination shows that it would be hardly worth the while to make the attempt. The old stock is of indifferent quality, as a rule, and the instruments have not given satisfaction to the Army in many cases when used as they are.

The telephones supplied by annual rental for use on target ranges have been rearranged with a view of making the equipment of certain ranges as nearly permanent as possible and of dispensing with a number not essential.

The practice of renting telephones and transmitters from one source and obtaining call-boxes, batteries, etc., from another and adjusting the various parts at this office has not been found satisfactory in all respects nor economical, and later purchases have secured the outfit complete at the same hands.

The *homing-pigeon* service at Key West has been discontinued and the birds transferred to the superintendent of the Naval Academy. The experiment had been carried to the point of obtaining return flights from Havana, and has shown that they are reliable across quite extensive stretches of water and can undoubtedly be made use of by the Navy as messengers from shipboard to the home station. The experiment has been conducted through a period of four years at an annual cost of $276.67. That expenses could be kept so low is due to the courtesy of the Quartermaster-General, who made available a vacant barrack, and that of private parties, who furnished the original stock without cost to the Government. As a return to those who supplied the birds the service has always extended facilities to fanciers throughout the country in their training flights, and by so doing has incidentally become aware of the great number of birds raised and trained for long flights, which could be made available for war purposes in case of necessity.

The experimental *signal lanterns* have been fully tested in the West and found to give a range of 15 miles with the naked eye. Free criticism was invited as to the merits and defects of the lanterns, and two, which gave the best results, have been selected for further tests. In many respects these two lanterns are excellent, but mechanical defects have been developed which, when remedied, will probably make one or both suitable for use in place of the objectionable torch.

A small *candle lantern* carrying a reflector, and a screen for cutting off and revealing the light, has also been tested and found an excellent substitute for the ordinary lanterns used by the first sergeants of companies. It serves the ordinary purposes of a lantern for the field, the squad room, or the stable, and is, as well, an effective signal equipment over a range of 2 or 3 miles, burning the ordinary candle of commerce. Fifty of these have been ordered and will be for issue the coming year to various posts and organizations for further test and report.

The demand for heliograph instructions has nearly exhausted the supply, but in view of changes in the new heliograph the preparation and issue of a new edition must necessarily be deferred.

The call for code cards has also been very great, to meet which a pocket card, setting forth in condensed form the material parts of the complete code, has been prepared and an edition of 10,000 printed. The alphabet, conventional signals, etc., have also been added to the back of the pads holding message blanks.

In line with the policy of placing material in the hands of chief signal officers of departments for issue to acting signal officers an ample supply of blank forms, code cards, instructions, etc., have been sent to the chief signal officer of the Department of Arizona. It is believed that requisitions for supplies and all communications from acting signal officers relative to signaling matters should, under ordinary conditions, be forwarded through the department signal officer and bear his recommendation and remarks before action by this office.

Storage having been found at Fort Riley, Kans., for a portion of the field telegraph train a section has been put in order for use at that important post. At present there are no draft animals available for use with this section, but arrangements to this end can probably be temporarily effected through the Quartermaster's Department.

The presence of an officer of the corps at Fort Riley with a signal detachment makes it possible to accomplish at this point a good deal in the way of experiment and drill with the implements and equipments of the corps not otherwise practicable, and no doubt facilities can be found so that it may be made not only a depot of supplies but a point at which repairs may be effected.

The following is a list of the books designed for reference and instruction at Riley:

Prescott's Electricity.
The Telephone. Dolbear.
The Electric Telegraph. Pope.
The Telephone. Preece and Maier.
Manual of Telegraph Construction. Douglass.
Handbook of the Electric Telegraph. Lockwood.
Electricity and Magnetism. Jenkins.
Electric Dictionary. Houston.
Electric Telegraph. Sabine.
Dynamo Electrical Machinery. Thompson.
Telegraph Manual. Shaffner.
The Telegraph in America. Reid.
International Code Signals.
Stewart's Treatise on Heat.
Text Book of Physics. Everett.
Absolute Measurements in Electricity. Gray.
Ganot's Physics. Atkinson.
Handbook of Electric Diagrams. Davis and Rae.
Instructions to Operators.
Electric Tables and Formulæ.
The Century Dictionary.
Deschanel's Natural Philosophy. Everett.
Text Book of the Principles of Physics. Daniel.
Dynamo Tender's Handbook.
Incandescent Wiring Handbook.
Stationary Steam Engines Adapted to Electric Lighting.
The Storage of Electrical Energy. Planté.

Dynamo Electricity. Prescott.
Practical Information for Telephonists. Lockwood.
Handbook of Practical Telegraphy. Culley.
Manual of Telegraphy. Smith.
Manual of Telegraphy. Williams.
The Philosophy and Practice of the Morse Telegraph. Smith.
Practical Electrical Measurements. Swinburne.
The Telephone, Microphone, and Phonograph. Du Moncel.
Electric Lighting. Du Moncel.
The Electric Engineer's Pocketbook of Modern Rules. Kempe.
Electricity and Magnetism. Stewart and Gee.
Practical Electricity. Ayrton.
Pocketbook of Electrical Rules and Tables. Munro and Jameson.
Notes on Electricity. Abbot.
Electrical Engineering. Slingo and Brooker.
Management of Accumulators. Salomons.
Electricity and Magnetism. Mascart.

One hundred and thirty-seven *field glasses* of aluminium, 50 of which are arranged with slings for carriage when out of case (the most satisfactory glass ever supplied), have been procured during the year. The distribution of these has been limited at present to general officers, inspectors of rifle and artillery practice, light batteries, and to the more important posts, some limitation being necessary, as the supply would not satisfy the demand. These glasses cost $26.88 each, but as future purchases must also include the import duty, the cost hereafter for the same glass will be about one-half more.

Relative to the purchase of field glasses by officers it should be remarked that, under present ruling, the sale is not authorized.

An excellent telescope in aluminium has been procured during the year as a model for future purchases.

Under the conditions in which artillery practice is now held, instruments of precision to record the velocity and direction of the wind, humidity, etc., are essential. While the old anemometer gives good record of velocities, yet such velocity can not be determined from this instrument at sight. A sample of a foreign instrument from which the velocity can be taken at a glance has been procured, but it was found that the office could construct a much better small equipment for artillery practice and the matter is now in the hands of Prof. Marvin. The professor has also devised a psychrometer which by the use of the tables specially prepared for the purpose, enables the humidity of the atmosphere to be quickly obtained, and with much accuracy. He has also in charge the preparation of a compass suitable for the use of signal officers.

At present the artillery ranges are supplied with *fixed* telephones, but if it were practicable to supply the *field kits* it is easily seen to what good use the field telephone could be put in this connection.

In order to make the record of officers and posts more readily accessible, sets of card indexes have been prepared whereby it is possible, by easy reference, to at once ascertain the history of the officer so far as relates to instruction and practice, and also the equipment of a post, the character and cost of supplies furnished on various requisitions, the amount of instruction held, etc.

This form of record is so satisfactory as to suggest the possibility of its adoption to good advantage in other directions.

An examination into the organization of foreign telegraph corps and the nature of the duties required of them, shows that, as a general thing, organizations are not only perfected for the peace establishment, but provision is made for expansion in war times. The present organization of our corps limits the number of enlisted men to 50. With this force disposed at stations on the military telegraph lines, schools of instruction, department headquarters, etc., it is not practicable to have in hand much of a detachment in readiness at all times for the field.

To become expert under present conditions not only is constant practice and instruction in the ordinary methods of signaling necessary, but the men must be made electrical experts, be familiar with scouting, surveying, and reconnoissance and the sketching incidental thereto; be skilled in the use of the balloon train, the field telegraph train, the telephone kit, the use and manipulation of the electric search light; construction, operation, and testing of telegraph lines and laying of cable, experts in ciphering and deciphering, etc.

To accomplish the training of officers and men must ultimately necessitate possession by the service of a post or station.

Information gathered from abroad from publications and the report of the military attaches is reduced to card record when advisable, and work in this direction must continue to increase as the corps assumes the functions of a bureau of military information, which have been imposed upon it by law.

Very respectfully, your obedient servant,

R. E. THOMPSON,
Captain, Signal Corps.

The CHIEF SIGNAL OFFICER, U. S. ARMY,
Washington, D. C.

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APPENDIX NO. 2.

REPORT OF THE OFFICER IN CHARGE OF TELEGRAPH DIVISION.

SIGNAL OFFICE, WAR DEPARTMENT,
Washington, June 30, 1891.

SIR: The officer in charge of the telegraph division has the honor to submit the following report regarding the maintenance and operation of the U. S. military and seacoast telegraph lines during the fiscal year just closed.

There were in operation at the date of the last report 1,337 miles of military and 621 miles of seacoast lines. Of the former, 1,025 miles remain in operation at the close of the year, and the mileage of the latter has been increased to 634 miles by the extension of the Point Reyes line.

The following table shows the location of the lines by departments and coasts, together with their length and changes during the year:

	In operation.		Changes.
	July 1, 1890.	June 30, 1891.	
I. Military lines:	*Miles.*	*Miles.*	
Dakota	282	85	Abandoned Fort Maginnis line, 186 miles; and Fort Totten line, 11 miles.
Missouri	126	109	Abandoned Fort Elliott line, 17 miles.
Texas	124	112	Added 10 miles, Fort Clark to Spofford Junction. Lost 22 miles, abandoning Fort Davis line.
California	12	12	No change.
Arizona	493	417	Gained 2 miles rebuilding San Carlos line, and 10 miles by taking up Fort Bayard line. Lost 40 miles, discontinuing Fort Verde line; 27 miles, Fort McDowell line; 7 miles, Fort Lowell line; and 14 miles by shortening Fort Stanton line.
Platte	300	290	Abandoned Fort Bridger line, 10 miles.
Total	1,337	1,025	
II. Seacoast lines:			
Pacific	158	171	Gained 13 miles extending Point Reyes line.
Atlantic	463	463	No change.
Total	621	634	

With a very few exceptions—such as the breaking of submarine cables which could not be repaired or renewed without considerable delay or without Congressional action, the occurrence of disastrous floods, notably in Arizona and Oklahoma Territories, etc., the military seacoast telegraph lines have been maintained in a high state of efficiency during the past year. In anticipation of the changes that will take place in the management of these lines with the beginning of the new fiscal year, officers in charge and post commanders were requested, in November last, to inform this office what additional materials, instruments, labor, etc., would be required to fully equip their lines and place them in the best possible state of repair by July 1. All requisitions received under this letter were filled, so far as was deemed necessary, and general repairs authorized to the limit of the appropriation then available.

Generally speaking, the men serving on the military and sea coast telegraph lines have performed their, frequently onerous, duties with that zeal and fidelity that have always characterized the men of the Signal Corps; often under conditions of great hardships, isolation and risk of health and even life itself. Their soldierly conduct at military posts, in connection with the superior educational advantages enjoyed by most of them, secured the respect and esteem of their military superiors, almost without exception. Now, that under the operation of the new law most of these men will be mustered out of the Signal Corps, it seems proper to make special mention of this gratifying feature of the old service. Under the same law, the seacoast lines will be transferred to the Weather Bureau, leaving only the purely military lines under the control of the Chief Signal Officer.

A brief summary of the lines in the various military departments, as operated during the past year, is given as follows:

Department of Dakota.—As indicated in last year's report, the Fort Maginnis line, 186 miles long, was abandoned and all offices closed to date July 1, 1890, consequent to the abandonment of Fort Maginnis as a military post. For a like reason the operation of the Fort Totten line, 11 miles was discontinued in November, and the iron poles in use on that line were recovered and shipped to Fort Custer.

On the Fort Custer section extensive repairs were made by troops during November and December, including the replacing of 443 wooden poles with iron ones. The line has now 558 iron and 202 good cedar poles, with a more than sufficient reserve of spare iron poles to replace the remaining wooden ones, as may become necessary.

The Bismarck-Fort Yates line has remained in very efficient working order. The Northwestern Telephone Company's poles between Mandan and Fort Abraham Lincoln, which had carried the military wire for several years, were purchased by this service for the very moderate sum of $200. South of the fort the line now requires 300 new poles, which have already been purchased and, together with other line materials, shipped to the Cannon Ball River, where troops from Fort Yates will begin general repairs during July next.

The Signal Corps observers at Forts Sully, Buford, and Assinniboine have continued to operate the Western Union branch lines to those posts, to facilitate the transmission of public messages; the small amount of business at those points not warranting the company to supply operators of its own.

Department of the Missouri.—The discontinuance of the military post of Fort Elliot led to the abandonment of the line thence to Miami, 17 miles on September 30. The line was dismantled by troops, and the material thus recovered shipped to points where needed.

The line from Fort Sill to Fort Reno and El Reno remained in excellent working order until June, when the towers, or derricks, supporting the wire at the crossing of the South Canadian River were washed away by the disastrous freshet then prevailing. The damage was repaired by the military authorities as soon as the river had resumed its normal condition.

The Fort Supply and Fort Lewis sections have been operated under the control of the local military authorities. As the troops are to be withdrawn from Fort Lewis on or before October 1, 1891, the latter section will probably be abandoned at an early date.

Department of Texas.—The new line from Fort Clark to Spofford Junction was completed early in September, under the supervision of an expert Signal Corps lineman. The poles were cut by troops, and the other materials supplied by this service from lines no longer in use. The line is operated without extra expense, and carries no commercial business.

The line from Brownsville to Fort Ringgold was thoroughly overhauled by detachments from those posts, under the supervision of two Signal Service operators. The work was completed March 12.

The other lines in this department are the Fort Davis-Marfa section, operated with telephones, and a loop from Department Headquarters at San Antonio to the Western Union office in the city, which has been operated by the Signal Corps observer. The Fort Davis section was discontinued June 30, consequent to the abandonment of the post.

Department of California.—The only military line in this department consists of about 4 miles of cables and 8 miles of land lines, connecting Department Headquarters and the Signal Office at San Francisco with the military posts at Fort Mason, the Presidio, Alcatraz Island, and Angel Island. Since the break in the direct cable between Fort Mason and Alcatraz Island, business for the island posts had to be sent over commercial lines as far as Tiburon, until the extension of the Point Reyes line and the renting of a conductor in the commercial cable across the Golden Gate rendered direct communication again possible. The cable between Tiburon and Angel Island gave out in September, and as it was reported that the same could not be repaired without heavy expense, a quantity of new spare cable was shipped from this office, but before it arrived at San Francisco the old cable had been repaired, with the assistance of the military authorities, at an expense of $350. With a view to restoring direct communication between Fort Mason and Alcatraz Island, after the separation of the military and seacoast lines shall have rendered the use of the conductor in the Golden Gate cable impracticable for military purposes, the Chief Signal Officer ordered some 4,000 yards old cable shipped to San Francisco from Woods Holl. This cable is now stored under water near the Presidio, but will require careful examination and repairs before using. The fact that it was found impossible to maintain former cables over this route, on account of the great liability to damage from anchors, would seem to make it inexpedient to lay another one under present conditions. The cable might be held in readiness for an emergency, as in case of war, or a much longer one should be provided, to admit of a route outside the anchoring grounds. In the meantime business to and from the islands can be handled over the Western Union lines between San Francisco and Tiburon, to be transferred to the Government cable at the latter point.

Department of the Columbia.—Under orders from the War Department, the commercial (formerly Signal Service) line from Fort Spokane to Davenport was to be put in thorough repair by troops, and maintained thereafter by the military authorities. This service furnished a considerable quantity of new poles and other line material for the reconstruction of the line, and also authorized the employment of an expert lineman for one month to superintend the work, which, at last accounts, had not been entirely completed.

Department of Arizona.—In consequence of the abandonment of the military posts of Forts Verde and McDowell, the lines from Whipple Barracks to Fort Verde, and from Fort McDowell to Phœnix, were discontinued in July. The iron poles were recovered and shipped to Wilcox for use on the Fort Apache section. Similar action was had with regard to the telephone line from Fort Lowell to Tucson, which was discontinued in April.

Communication over the Fort Apache section was seriously interrupted during February and March, owing to severe freshets in the Gila and Little Colorado rivers, which not only did much damage to the line, but prevented the repair parties from crossing to make repairs. During the continuance of the flood messages to and from San Carlos were flagged across the river from temporary signal stations. The southern end of the section, from Wilcox to Fort Bowie, was largely reconstructed on iron poles during February and March. The Signal Corps operator at Fort Bowie rendered valuable services in supervising the work of the troops.

The terminus of the Fort Stanton line was changed from Lava to Carthage, by which the line was shortened about 14 miles. The work was done by troops, and occupied one month, from October to November, in its completion. Contrary to the inintentions of the Chief Signal Officer, the Signal Corps expert from Lava was employed in operating temporary stations along the new route instead of supervising the work of construction, which was poorly done in consequence. Another detachment left Fort Stanton during the present month, accompanied by the Signal Corps operator from Carthage, to remedy the defects of original construction.

The Fort Wingate, Fort Union, and Fort Bayard lines are operated under the control of the respective post commanders.

Department of the Platte.—The line from Fort Bridger to Carter was dismantled in October, owing to the abandonment of the post. The iron poles were recovered and shipped to Forts Custer and Riley.

The 1,188 iron poles that had been shipped to Price, Utah, from various abandoned lines were put into the Fort Du Chesne line by troops, July 16 to 31. It is estimated that 1,000 more iron poles are necessary to put this line in lasting good repair, as wooden poles are liable to be cut down by freighters or rubbed down by cattle.

On the Fort McKinney line $100 was expended for general repairs in October last. On the recommendation of an inspecting officer it was ordered that a number of iron poles be shipped to Fort McKinney during May, but the order was cancelled on receipt of information that the post would probably be abandoned in the near future.

The Fort Washakie line received general repairs on several occasions, and has been maintained in a fair state of efficiency. It is in a very weak condition, however, and will require several thousands of new poles and many miles of new wire to put in good repair. As this line is only leased by the Government, and is not provided for under the law making appropriations for military telegraph lines, the Chief Signal Officer has always declined to expend more money on the same than was absolutely necessary to maintain communication from year to year, but in the course of another year a considerable outlay of money and labor will have to be made or the line must be abandoned.

SEACOAST LINES.

Atlantic coast.—The line from Norfolk to Hatteras, with its cable branch to Cape Charles, remained in excellent working order until January 16, when, during the progress of a severe storm, the cable across Oregon Inlet was broken and its shore ends torn from their landings. Immediate steps were taken, under the personal supervision of Lieut. Ellis, to recover and repair the cable, but it was found that the north end was so deeply buried in the sandy shoals as to render its recovery impossible, and that a new cable would be necessary to restore communication with the line south of the inlet. As this required Congressional action involving a delay of several months, the station at Hatteras was temporarily closed and the operator at Kitty Hawk directed to telegraph meteorological reports in the meantime. A new cable, about 2½ miles long, was successfully laid June 6 to 7, and the telegraph office at Hatteras reopened two weeks later. The new cable is of a much heavier type than the old one and, like the latter, has two conductors, one of which can be used for the Life-Saving Service telephone line. Its greater weight and length make it more secure against damage from storms, and the shore ends were carried far enough inland to prevent washouts for years to come. The fact that shortly after the break in the old cable three shipwrecks occurred in the immediate vicinity, involving a loss of 19 human lives, emphasized the importance of maintaining telegraphic communication with that dangerous locality.

The Cape Charles cable was broken April 18, about 1 mile from the Cape Henry end, presumably by the anchor of the steam pilot boat *Pilot.* The broken ends were found nearly one-half mile apart, and as it was found impossible to pull them together they were buoyed in the best manner practicable, and a sufficient quantity of spare cable was ordered shipped from Block Island to splice into the break; but owing to lack of funds the final work of making repairs had to be postponed until after July 1.

Much work was done on the land lines also. The old line from Norfolk to Kempsville was abandoned and a new wire strung on the railroad and Western Union Company's poles between those points. The new route required a short cable for the draw in the bridge across Deep Creek. The work was completed during October. Thirty-three miles of new wire and 300 new wooden poles were put into the line between Cape Henry and Currituck Inlet, and 20 new poles and 6 miles of wire on the Kitty Hawk section. During the coming year some 800 new wooden poles, 65 miles of new wire, and a corresponding number of insulators and brackets will be required to put the Hatteras, Kitty Hawk, and Currituck Inlet repair sections in good condition.

On the Wilmington-Southport line but little work has been necessary. Some 80 iron poles were replaced with wooden ones in March.

The line from Titusville to Jupiter was thoroughly cleared of overhanging limbs and underbrush during August and September. It is reported to be in excellent condition at present.

Excepting the damage done during a severe sleet storm in January, which bent the iron poles nearly to the ground, the Block Island line, including 11 miles of cable, has remained in good working order. The damage referred to was promptly repaired.

The Nantucket system of cables and land lines suffered no serious interruption during the year. All of the iron poles remaining in use on the main line were replaced with wooden ones in January. The lines proved of great value in connection with the wrecks of the U. S. steamships *Galena* and *Triana*, March 12, when the Signal Corps operator at Vineyard Haven established a flying station at Gay Head to facilitate the transmission of important public dispatches. His services on that occasion were acknowledged in a special letter from the Secretary of the Navy to the Secretary of War. Much of the success in the efficient operation of the Nantucket system is due to the zeal and ability of the chief operator, Sergt. B. A. Blundon, Signal Corps.

Pacific coast.—The work of extending the Point Reyes line from Tiburon to Lime Point was completed during July, but owing to a series of unfortunate delays on the part of the local management, due to the pressure of other duties or to other causes, the reconstruction of the line between Fort Point and San Francisco was not completed until December 3, on which date the line was connected with the rented conductor in the cable across the Golden Gate and direct communication with Point Reyes reëstablished. On the original line $150 was expended for general repairs, a lack of funds preventing the more expensive but very necessary work of setting 100 new poles at points where the wire is now carried on trees. The officer in charge at San Francisco reports that the bark *Electra* and the schooner *Sylvia Handy*, while in distress off Point Reyes, were saved through the agency of the Government line in summoning assistance.

The cable across Wallacut River, on the Washington side of the Astoria-Fort Canby section, was broken in September and found to be worthless for repair. The further use of a cable at this point was dispensed with by constructing a span on high poles to carry the line over the draw in the bridge. The large cable at the mouth of the Columbia River has given no trouble whatever. Extensive repairs are needed to the land line on the Washington side of the river.

As anticipated in last year's report the special appropriation of $6,800 for renewing the Tatoosh Island cable and land line proved insufficient for the purchase of a cable alone, as the new tariff laws made no provisions for importing Government cables free of duty. Under subsequent legislation a very heavy cable has been contracted for, which is now on the way from London, and the work of reconstructing the land line from Port Angeles to Cape Flattery was begun during June. It is expected that communication with Tatoosh Island can be restored on or before August 1.

Respectfully submitted.

H. H. C. DUNWOODY,
Major Signal Corps, Telegraph Officer.

The CHIEF SIGNAL OFFICER.

REPORT SHOWING THE WORK OF THE TELEGRAPH ROOM AT THIS OFFICE.

During the past year there were audited 250 bills for telegraphic services. Twenty-four estimates, based on the rates fixed by the Postmaster-General, were furnished the disbursing officer.

There were received and sent from this office 1,250,000 cipher words and 83,000 telegrams.

Forms 204 B, 211, and 232 were received from all stations and the necessary correspondence in reference thereto transacted.

Daily wire reports of the various circuits were made up and the necessary letters written in reference to weather reports not filed or transmitted on schedule time.

The telegraph service has been excellent with but one exception, when in consequence of a heavy sleet storm during the night of January 24-25 direct communication with New York City remained interrupted until the evening of January 29. During this period the New England and Lake region reports were received here via Chicago, Cincinnati, and Augusta.

TABLE SHOWING AMOUNT OF CASH RECEIPTS AT STATIONS OF THE UNITED STATES MILITARY TELEGRAPH LINES FOR THE FISCAL YEAR ENDING JUNE 30, 1891.

[Cash belonging to the United States.]

Stations.	Amount.	Stations.	Amount.
ARIZONA DIVISION.		NORTHERN DIVISION—cont'd.	
Holbrook section:		Du Chesne section:	
Holbrook, Ariz	$22.41	Fort Du Chesne, Utah	99.63
Fort Apache, Ariz	83.51	Taylor Ranch, Utah	$2.12
Fort Bowie, Ariz	26.60	Price, Utah	48.74
Fort Grant, Ariz	109.45	Washakie section:	
Fort Thomas, Arz	135.45	Fort Washakie, Wyo	178.45
San Carlos, Ariz	233.86	Rawlins, Wyo	137.37
Willcox, Ariz	280.97	Bismark section:	
Fort Stanton section:		Bismark, N. Dak	203.61
Fort Stanton N. Mex	73.16	Fort Yates, N. Dak	109.65
Carthage, N. Mex	56.54	Custer section:	
		Fort Custer, Mont	63.11
NORTHERN DIVISION.		Custer Station, Mont	87.71
		Canby section:	
		Fort Canby, Wash	368.96
Brownsville section:		Astoria, Oregon	112.85
Brownsville, Tex	173.07	Elliott section:	
Rio Grande City, Tex	284.85	Fort Elliott, Tex. (abandoned Oct. 1, 1890).	18.55
Reno section:			
Fort Reno, Okla	62.70		
Fort Sill, Okla	37.97	Total	3,011.28

RECEIVED IN TRUST FOR THE WESTERN UNION AND OTHER COMMERCIAL TELEGRAPH COMPANIES ON ACCOUNT OF THEIR TOLLS.

Stations.	Amount.	Stations.	Amount.
ARIZONA DIVISION.		NORTHERN DIVISION—cont'd.	
Holbrook section:		Du Chesne section—Cont'd.	
Holbrook, Ariz	$1.50	Taylor Ranch, Utah	$14.39
Fort Apache, Ariz	227.07	Price, Utah	41.30
Fort Bowie, Ariz	106.95	Washakie section:	
Fort Grant, Ariz	355.51	Fort Washakie, Wyo	420.59
Fort Thomas, Ariz	251.71	Rawlins, Wyo	00.00
San Carlos, Ariz	773.79	Bismarck section:	
Willcox, Ariz	504.25	Bismarck, N. Dak	61.57
Stanton section:		Fort Yates, N. Dak	428.83
Fort Stanton, N. Mex	476.26	Custer section:	
Carthage, N. Mex	56.07	Fort Custer, Mont	461.86
		Custer Station, Mont	00.00
NORTHERN DIVISION.		Canby section:	
		Fort Canby, Wash	1,141.18
Brownsville section:		Astoria, Oregon	138.75
Brownsville, Tex	.00	Elliott section:	
Rio Grande City, Tex	471.45	Fort Elliott, Tex. (abandoned Oct. 1, 1890).	68.76
Reno section:			
Fort Reno, Okla	428.06		
Fort Sill, Okla	347.99	Total	7,287.89
Du Chesne section:			
Fort Du Chesne, Utah	510.05		

APPENDIX 3.

REPORT OF THE OFFICER IN CHARGE OF THE VERIFICATION OF OFFICIAL FORECASTS.

SIGNAL OFFICE, WAR DEPARTMENT,
Washington City, June 30, 1891.

SIR: The verification of the official forecasts issued upon the daily 8 p. m. observations for the year ending June 30, 1891, have been determined by the established rules, and I have the honor to submit herewith the accompanying tables of percentages in detail.

In originally devising and arranging the rules that are now in force for determining the percentages of verifications it was a chief consideration to make the percentages represent, with the closest approximation possible, a fair and just estimate of the extent of success of each forecast, not only as measured and estimated by popular impression, but also paying due regard to what we may term the mathematician's conception of the requirements of problems of this kind. The popular opinion in many cases is less uniformly impartial and precise, and is often based upon individual impression affected by accidental circumstances rather than definite and indisputable observations.

While it will be generally admitted by anyone studying the question closely that our rules for determining the percentages of verifications are just and impartial and based upon correct principles, yet the weather problem with which we are dealing is so exceedingly complicated that in publishing opposite a series of forecast officials' names a series of percentages of verifications, it is only just to particularly point out a matter well known and understood by those fully versed in the subject, namely, that such percentages are not strictly comparable, and hence do not definitely and with certainty measure the respective ability of those concerned. The reasons for this are principally because of the much greater difficulty of successfully forecasting rainy and unsettled than fair weather, together with the seasonal and spasmodic variations in their respective occurrence. No clearer proof of this need be sought than that presented by a comparison of the percentages of verifications of the forecasts for the Pacific coast. Year after year these percentages are higher than for the rest of the country, not, it is believed, because of any greater ability of the official having charge of that district but simply because of the greater frequency of conditions most favorable for successful forecasts. The gradation of percentages downwards as we pass northward from the dry sunshiny climate of southern California to the more ordinary and rainy climate of Washington is very marked.

Similar circumstances, seemingly with little or no special order of sequence either as to time or locality, prevail also over the region east of the Rocky Mountains, though in much less marked degree, so that while the percentages represent closely, it is believed, the success attained under the respective conditions, yet so long as forecasts are made by only one official at a time, their respective ability can not be fairly determined except by the mean of many months' work.

It has often been thought to reduce various monthly percentages to a comparable basis by applying a system of monthly corrections or constants of reduction to the average. I am myself, however, convinced from a close examination of the details that such corrections are highly arbitrary, and can not be definitely identified with any particular month any more than the particular weather of each month is closely identical year after year. The variation in successive monthly percentages is, on the average, only a few per cent, and to eliminate from this small variation that portion due to monthly or seasonal peculiarity requires a far nicer and refined mathematical analysis than the data and material at hand render possible. So many changes have been made from time to time in methods of forecasts and rules for verification that only little strictly comparable data is on hand. These conclusions are alike applicable to wind-signal displays and to weather and temperature forecasts.

In the Annual Report for 1888, p. 60, table 2, is given the average monthly percentages of justification of the display of wind signals for a period of eight years ending 1888. This table shows in a striking manner that the percentages are lowest in the summer months and highest in the winter. If, however, we take the percentages for the past three years, during which new rules governed the display and verification of wind signals, no such gradation of percentages exists, and it appears very arbitrary to endeavor to establish any system of monthly corrections or reductions to averages.

A third year has now passed, during which there has been practically no changes in either the material or manner of preparing forecasts or in the rules and principals for their verification.

The percentages of weather forecasts for all States is 1.7 per cent higher than last year and 2.5 per cent higher than in 1888-'89. The temperature forecasts for this year are only 0.2 per cent behind those of last year and 2.7 per cent higher than those of the year ending June 30, 1889.

The yearly averages of weather and temperature combined for the three years just passed are:

	Per cent.
1889	81.0
1890	82.6
1891	83.5

A very gratifying increase is found also in the yearly averages of the percentages of justification of the display of wind signals, which are as follows:

	Per cent.
1889	67.3
1890	67.1
1891	70.9

The detailed percentages are given in the tables which follow.

C. F. MARVIN,
Assistant Professor in Charge Verifications.

The CHIEF SIGNAL OFFICER.

TABLE I.—PERCENTAGES OF VERIFICATIONS OF 8 P. M. TWENTY-FOUR HOUR FORECASTS OF WEATHER AND TEMPERATURE FOR THE YEAR ENDING JUNE 30, 1891.

States.	1890.						1891.						Average per cent.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	
Maine	80.4	80.1	80.7	80.3	82.4	81.9	80.6	90.6	85.4	78.3	79.7	77.5	81.5
New Hampshire	81.2	82.7	79.8	73.2	81.5	84.2	78.2	94.9	79.4	75.1	78.9	76.2	80.4
Vermont	79.6	82.8	80.8	75.0	81.0	86.1	76.7	92.1	79.8	78.9	83.5	77.5	81.2
Massachusetts	78.1	83.8	77.3	76.3	81.5	79.9	82.3	92.6	75.3	84.5	87.2	81.9	80.9
Rhode Island	78.5	84.4	77.2	86.8	85.9	83.2	82.4	97.4	76.5	80.4	88.5	80.8	83.5
Connecticut	75.8	75.9	77.2	82.1	78.8	83.2	84.2	95.0	80.8	78.7	87.0	84.3	81.9
Eastern New York	80.6	80.1	80.5	84.3	80.8	84.8	81.7	93.4	76.6	91.5	83.2	82.3	83.3
Western New York	84.2	84.5	82.9	84.1	75.6	74.3	83.5	89.3	77.1	85.1	77.5	78.2	81.4
Eastern Pennsylvania	78.2	85.9	81.5	86.8	85.2	83.8	87.7	90.6	87.4	86.7	83.9	84.5	85.2
Western Pennsylvania	84.6	83.7	79.9	79.3	82.7	79.4	77.2	92.4	81.9	86.3	76.7	76.8	81.7
New Jersey	81.4	83.3	75.3	87.1	89.9	85.3	87.0	89.6	84.3	88.1	79.5	83.5	84.5
Delaware	81.0	93.7	76.1	84.3	89.5	87.0	84.3	92.3	87.9	83.7	84.2	83.7	84.8
Maryland	83.8	82.1	81.5	86.6	88.4	86.7	85.9	89.8	86.3	86.1	86.9	80.3	85.4
District of Columbia	84.5	81.7	82.7	88.3	88.1	85.7	84.9	92.4	85.7	86.5	83.0	78.0	85.1
Virginia	80.5	84.9	81.0	84.0	85.3	85.5	85.2	90.1	83.9	86.3	84.5	76.1	83.9
North Carolina	83.8	84.6	81.4	84.3	90.0	84.3	86.9	86.5	81.3	79.0	86.8	74.9	83.6
South Carolina	83.7	82.2	76.7	92.7	90.4	85.4	89.9	84.5	79.7	85.0	87.1	82.0	84.9
Georgia	82.5	87.2	70.6	92.8	92.0	81.9	90.6	81.7	79.5	83.8	90.6	80.9	84.5
Eastern Florida	88.4	93.6	82.9	90.6	85.0	85.2	90.6	87.3	86.7	82.5	92.8	87.1	87.7
Western Florida	85.4	85.0	83.2	92.1	93.1	84.1	89.8	86.8	83.9	86.9	96.4	80.3	87.2
Alabama	86.6	89.6	77.7	91.4	93.7	91.4	88.3	87.6	80.5	85.7	89.7	79.8	86.8
Mississippi	84.2	87.7	75.9	91.0	96.2	91.5	89.5	85.1	81.1	82.5	89.0	76.5	85.8
Louisiana	87.5	88.9	75.4	90.8	92.2	89.7	89.0	86.6	74.9	81.0	89.9	75.0	84.2
Texas	93.5	90.6	82.1	85.9	87.6	82.8	82.7	83.2	80.3	81.0	86.1	83.7	85.0
Arkansas	87.7	87.4	72.9	85.9	89.9	79.5	90.3	88.3	78.3	78.8	82.8	77.7	83.3
Tennessee	83.5	86.8	72.8	87.0	87.9	82.2	86.3	88.5	75.9	76.5	86.0	76.9	82.5
Kentucky	87.7	83.6	76.7	85.7	85.0	84.6	83.8	83.9	79.9	79.5	85.8	81.5	83.1
Ohio	85.6	86.5	81.0	84.8	79.1	81.4	79.7	90.5	83.9	82.3	79.6	76.2	82.6
West Virginia	80.3	78.4	80.0	86.4	87.1	85.4	81.9	90.7	83.2	83.2	77.5	83.9	83.2
Indiana	87.4	84.9	74.3	82.6	85.5	79.2	89.5	89.9	79.4	80.5	86.1	80.7	83.3
Illinois	86.0	88.3	74.7	81.0	87.9	88.4	86.9	90.9	81.1	82.3	88.8	83.5	85.0
Lower Michigan	82.1	86.1	82.6	78.9	85.0	74.9	85.0	90.4	79.4	78.7	85.5	74.5	81.9
Upper Michigan	77.9	79.0	80.2	76.4	77.1	72.6	77.9	82.2	84.5	82.5	86.9	74.5	79.3
Wisconsin	77.7	84.4	83.3	75.4	87.8	84.4	85.5	86.4	87.7	88.3	84.0	72.7	83.1
Minnesota	78.8	82.1	83.5	77.7	87.5	88.8	82.2	83.9	83.5	84.1	87.9	77.2	83.1
Iowa	84.6	80.1	82.9	75.2	88.3	86.6	90.4	83.8	81.8	82.5	86.2	78.5	83.4
Kansas	82.9	84.0	77.5	83.1	85.1	86.1	90.3	80.6	80.0	83.8	82.9	76.9	82.8
Nebraska	84.1	82.4	83.8	86.3	85.1	82.8	90.0	78.9	81.2	87.2	87.2	77.5	83.9
Missouri	85.8	85.8	78.1	77.7	85.5	84.5	89.4	87.7	89.9	81.9	89.5	79.2	84.6
Colorado	79.0	85.1	81.9	83.0	88.9	84.3	87.7	77.6	79.5	81.5	80.8	75.2	82.0
Dakota, North	87.4	83.9	82.1	78.7	85.7	86.6	83.6	86.4	77.7	79.0	88.3	68.5	82.3
Dakota, South	82.6	77.0	83.1	83.2	86.7	85.0	82.5	79.1	82.7	79.3	88.0	78.1	82.3
Weather	86.4	86.0	83.0	88.5	88.8	85.7	86.7	90.4	87.2	88.0	88.8	83.5	86.9
Temperature	78.2	81.5	73.9	77.1	82.4	81.2	83.0	84.2	73.0	74 9	80.3	72.1	78.5
Weather and temperature combined	83.1	84.2	79.4	83.9	86.2	83.9	85.2	87.9	81.5	82.8	85.4	78.9	83.5
Pacific coast.													
Southern California	94.0	89.8	87.9	91.8	95.9	90.9	96.3	83.4	93.0	92.7	89.1	96.6	91.8
Northern California	92.2	90.2	85.8	87.8	94.3	89.1	91.2	92.3	81.7	86.7	86.3	92.2	89.2
Oregon	84.7	85.7	88.3	83.2	92.5	86.8	83.3	85.7	78.5	78.9	80.1	84.6	84.4
Washington	85.8	87.3	87.9	80.9	88.1	85.0	81.4	82.3	84.1	81.5	80.3	81.9	83.9
Weather	95.9	94.0	92.4	93.4	94.6	89.0	87.7	85.2	87.4	89.0	89.9	90.1	90.7
Temperature	79.1	79.6	80.1	74.8	89.9	86.5	88.6	87.1	79.7	78.9	75.0	86.9	82.2
Weather and temperature combined	89.2	88.2	87.5	86.0	92.7	88.0	88.0	86.0	84.3	85.0	83.9	88.8	8.73

TABLE II.—VERIFICATIONS OF 8 P. M. FORTY-EIGHT AND SEVENTY-TWO HOUR FORECASTS OF WEATHER AND TEMPERATURE FOR THE YEAR ENDING JUNE 30, 1891.

Months.	Forty-eight hour.					Seventy-two hour.				
	Weather.		Temperature.		Weather and temperature combined.	Weather.		Temperature.		Weather and temperature combined.
	Forecasts.	Verifications.	Forecasts.	Verifications.		Forecasts.	Verifications.	Forecasts.	Verifications.	
1890.	*No.*	*P. ct.*	*No.*	*P. ct.*	*P. ct.*	*No.*	*P. ct.*	*No.*	*P. ct.*	*P. ct.*
July	72	87.4	54	48.1	73.5	13	87.6	7	44.3	76.2
August	18	58.1	26	65.4	61.8	......	......	......	......	......
September	111	75.8	104	81.2	77.8	......	......	......	......	......
October	11	60.0	3	83.3	63.6	......	......	......	......	......
November	254	94.6	78	86.7	93.3	12	95.0	7	18.6	73.6
December	243	84.1	158	94.4	87.5	25	96.0	......	......	......
1891.										
January	73	56.6	43	90.2	66.1	......	......	......	......	......
February	98	51.6	75	88.3	64.0	......	......	......	......	......
March	49	76.9	23	100.0	82.8	6	53.3	......	......	......
April	214	93.8	115	87.0	92.4	......	......	......	......	......
May	92	91.8	37	97.0	93.0	......	......	4	100.0	......
June	181	86.4	57	83.5	85.9	40	96.2	......	......	......
Total	1,416	83.8	773	85.2	84.1	96	92.2	18	46.7	87.1

TABLE III.—STATEMENT OF PERCENTAGES OF JUSTIFICATIONS OF WIND SIGNALS FOR THE YEAR ENDING JUNE 30, 1891.

Month.	Total signals ordered.	Justified as to velocity.		Justified as to direction.	Cautionary.			Storm.			For easterly winds.		For westerly winds.		Wind without signals.	Signals ordered late.	Percentage of justifications.
						Justified as to velocity.			Justified as to velocity.								
		Wholly.	Partly.		Ordered.	Wholly.	Partly.	Ordered.	Wholly.	Partly.	Ordered.	Justified.	Ordered.	Justified.			
1890.																	
July	48	34	...	43	48	34	...	...	...	...	26	22	22	21	22	1	63.3
August	51	32	...	51	50	31	...	1	1	...	11	11	40	40	20	6	62.5
September	45	30	3	44	45	30	3	...	...	...	20	19	25	25	25	12	58.5
October	121	79	9	112	88	54	6	33	25	3	48	42	73	70	17	10	71.7
November	106	79	3	99	99	74	1	7	5	2	21	16	85	83	20	28	69.9
December	95	70	12	93	49	33	7	46	37	5	20	18	75	75	18	11	77.5
1891.																	
January	87	73	7	81	52	41	6	35	32	1	33	29	54	52	13	9	81.7
February	116	76	6	110	88	57	3	28	19	3	25	23	91	87	24	10	69.7
March	114	94	7	111	79	63	4	35	31	3	69	67	45	44	15	14	82.1
April	91	53	7	89	78	44	4	13	9	3	28	26	63	63	19	10	67.0
May	76	60	1	73	76	60	1	0	0	0	36	33	40	40	20	11	73.0
June	20	13	...	20	20	13	...	...	...	...	17	17	3	3	29	6	41.5
Total	970	693	55	926	772	534	35	198	159	20	354	323	616	603	242	128	*70.9

* Yearly per cent.

TABLE IV.—VERIFICATIONS OF COLD-WAVE SIGNALS, AND TEMPERATURE - FALL WARNINGS, YEAR ENDING JUNE 30, 1891.

	Cold-wave signals.			Cold waves without signals.	Percentage, including cold waves without signals.	Temperature-fall warnings.			Percentage of verifications, cold wave, and temperature fall warnings combined.
	Ordered.	Verified.	Percentage.			Ordered.	Verified.	Percentage.	
1890.									
November	60	16	26.7	0	26.7	6	6	100.0	30.2
December	156	104	66.7	64	55.3	119	73	61.3	65.2
1891.									
January	188	103	54.8	9	53.5	119	59	49.6	53.5
February	378	265	70.1	44	66.2	103	50	48.5	67.5
March	114	62	54.4	20	50.0	74	26	35.1	49.7
April	0	0	......	0	......	16	6	37.5	37.5
Total	896	550	61.4	137	57.0	437	220	50.3	59.2

TABLE V.—PERCENTAGES OF FORECAST OFFICIALS, YEAR ENDING JUNE 30 1891.

Officials.	Months.	Weather.	Temperature.	Monthly average.	Wind signals.	General average.
Maj. Dunnwoody	August, 1890	86.0	81.5	84.2	62.5	78.0
	January, 1891	86.7	83.0	85.2	81.7	84.2
	Annual average.	86.4	82.2	84.7	74.1	81.7
Capt. Allen	July, 1890	86.4	78.2	83.1	63.3	77.4
	December, 1890	85.7	81.2	83.9	77.5	82.1
	April, 1891	88.0	74.9	82.8	67.0	78.3
	Annual average.	86.7	78.1	83.3	70.3	79.6
Capt. Thompson	September, 1890	83.0	73.9	79.4	58.5	73.4
Lieut. Glassford	October, 1890	88.5	77.1	83.9	71.7	80.4
	February, 1891	90.4	84.2	87.9	69.7	82.7
	Annual average.	89.5	80.7	85.9	70.7	81.5
Prof. Abbe	June, 1891	83.5	72.1	78.9	41.5	68.2
Prof. Hazen	November, 1890	88.8	82.4	86.2	69.9	81.5
	March, 1891	87.2	73.0	81.5	82.1	81.7
	May, 1891	88.8	80.3	85.4	73.0	81.9
	Annual average.	88.3	78.6	84.4	75.3	81.8
Lieut. Finley	July, 1890	95.9	79.1	89.2	......	......
	August, 1890	94.0	79.6	88.2	......	......
	September, 1890	92.4	80.1	87.5	......	......
	October, 1890	93.4	74.8	86.0	......	......
	November, 1890	94.6	89.9	92.7	......	......
	December, 1890	89.0	86.5	88.0	......	......
	January, 1891	87.7	88.6	88.0	......	......
	February, 1891	85.2	87.1	86.0	......	......
	March, 1891	87.4	79.7	84.3	......	......
	April, 1891	89.0	78.9	85.0	......	......
	May, 1891	89.9	75.0	83.9	......	......
	June, 1891	90.1	86.9	88.8	......	......
	Annual average.	90.7	82.2	87.3	......	......

APPENDIX 3.

[Part 2.]

WEATHER FORECASTING AT THE SIGNAL OFFICE JUNE ~~30, 1891~~.

On July 1, 1891, the duties of the Signal Office were divided, a part going to the Signal Corps proper and another part, that relating to the weather, was transferred to the Weather Bureau. It has seemed advisable to note a few of the more salient points and principles that have been established by the Signal Office in its work of forecasting the weather. It has been suggested that this work is done by intuition, and that it would be almost impossible for a good forecaster to impart his knowledge to another. This view needs a little explanation, I think. It means that long years of practice are needed to enable one, at a moment's glance, to grasp the more important points on a weather map, and to determine just what the indications are for the near future. It means that we can not draw up a formula into which we can enter certain quantities and then solve the equation. While a forecaster learns by practice to read a map quickly, yet, I think, if called upon at any time to give a reason for a certain forecast he would be able to explain his train of thought, though at the moment it may have come to him without a long study.

My own experience in this work has been since September, 1887, only. I found that no general principles had been laid down, and that it was necessary for each one to work out his own principles by a study of the maps. It must be admitted that there was a certain advantage to be gained in this experience, for by it one does not get his information second hand or in a way which he would find it difficult to apply, but he learns the work little by little, and by repeated failures finds just what he is able to tell fairly well and just where the doubtful points are. To my mind, however, there are certain fundamental ideas which can be written out quite easily and which will be of great help to a beginner in this work.

AVERAGE CONDITIONS ONLY TO BE PREDICTED.

First. We can hope to predict average conditions only. That is to say, taking five hundred maps in any month, the person who could go through those maps and make the best predictions, taking them as a whole, would be the most successful forecaster. Another person might do better on a hundred of the maps, but he could not take up a new map for that month and do as well as the first. The importance of this point may not at first be recognized. It is very essential to fix distinctly in mind that one must expect to forecast on an average condition only. If he finds a particular case in which he has failed he must learn to feel that were a similar case to come up, or even the very same case, he would make exactly the same prediction. It seems to me the best goal to set before one in forecasting is to be able to make the same prediction, from the same map, over and over again, no matter how many months have intervened between the trials, and though each attempt should give not more than 70 per cent as a result, for I feel sure there are such maps. If a person finds he has failed in any particular case and tries to apply that seemingly new principle on a subsequent apparently similar map, he will again fail, because the original forecast depended on an average condition and the second map was an average map.

A good example of this principle has been recently called to my attention by Prof. Carpmael, of Toronto, Canada. Several years ago one of his forecasters predicted a thaw on a map that had every appearance, as Prof. Carpmael thought, of a hard freeze; but sure enough the thaw came. Two or three years afterward another forecaster in examining the old maps came across the above abnormal case; and it so happened just about that time he had a map exactly like the former, and because of the success in the former case he predicted a thaw. When Prof. Carpmael saw the map he decided at once that there would be a very severe cold wave, and calling the attention of the forecaster to what the map seemed to indicate, he was shown the previous map on which the prediction of a thaw had been successful. In the second case, however, there was a very hard freeze, one of the worst of the whole winter. This would also seem to show that we cannot predict very satisfactorily upon the idea of types, but every map must be studied on its merits alone, without trying to find a previous one that looks almost exactly like it.

PERSISTENCY OF WEATHER CONDITIONS.

Another principle to be borne in mind is that prevailing conditions are, as a general thing, more likely to continue than to change. We have common proverbs which enforce this principle, "all signs of rain fail in a dry time;" "it will not stop raining till the moon changes," etc. It will be repeatedly found that when clouds are breaking away after a long rain it is unwise to forecast clearing for at least twelve hours. This is specially true for the lake regions and the mountains of the east part of the country. One of the first rules that a forecaster learns is that he is likely to anticipate altogether too much rain, and that there is often a remarkable persistency in fair weather conditions. Even after clouds come up in the southeast quadrant of a storm, unless rain has already begun falling to the westward, it is very dangerous to predict rain. This is especially the case if the high area in front of the storm has any tendency to the south or southeast.

FORECASTS CAN NOT BE MADE ON GENERAL LAWS.

The ordinary theory is that rain is generally caused by the condensation of moisture in an ascending current of warm, moist air. It is certain, however, that no use whatever can be made of this theory in forecasts. Rain certainly does not occur at the centers of our storms where we would naturally expect the strongest upward tendency. It does fall frequently in the southeast quadrant of storms, but even this rule can not be followed in forecasting rain for the reason that the distance from the center of the storm is very uncertain, and often there is no rain to the southeast. The only safe rule to follow is to locate, as near as possible, the position and extent of rain areas which have already begun, on successive maps. Oftentimes when scattered light rain has occurred in any region one feels very certain that rain is sure to occur at some points, but it is much safer not to try to predict the particular localities, but to leave out the rain prediction, for the reason that one is just as likely to put the "rain" exactly where it does not occur, and the "fair" just where it rains. This is especially the case west of the Mississippi River, and wherever there is not much rainfall.

NORTHERLY CURRENTS MEETING SOUTHERLY.

There is a single partial exception to the rule that rain can not be predicted on general principles, and this is when there is foreseen a marked movement of the air from both north and south areas toward each other. This occurs when a high area hovers over the Southern States and a partial trough is formed with another high to the north. Under these conditions, which ordinarily might be anticipated to give the clearest weather, clouds will frequently arise and light rains will fall. Even here, however, great caution is needed, and it is generally safer not to try to forecast rain unless one has seen rain already falling. This is especially the case in the colder months of the year.

LOCI OF STORMS.

It will be found that at certain times there is a remarkable persistency in the occurrence and beginning of storms in certain well-defined localities. One of the best marked of these is in west Texas, another is over Lake Michigan, still another over North Carolina. The latter often moves to the Middle Atlantic coast. In such cases storms seem to hover around these loci, oftentimes rain will emanate from a low area and spread over the whole country without any motion whatever of a low-pressure area. Such rains are the most difficult of all to predict, and occur usually at a time when the upper movement of the whole atmosphere is very much diminished. In fact, it may be laid down as a general rule that when there is a rapid movement of storms and high areas across the country the weather and temperature are far easier to predict than when this movement slows down. In the former case storms are much more likely to clear up clean and not leave straggling showers, the temperature, especially, runs in much more marked contrasts, and its changes are far easier to forecast.

RAINFALL ON THE GULF COAST.

Rain on the Gulf coast does not follow any rules at all except that if it has begun seemingly in the center of a fair condition one can not with safety predict anything but showers, and continue this prediction until the rain has ceased. This is especially true of Florida. A remarkable weather condition sometimes prevails on the Gulf, and this has not as yet been thoroughly studied. During times of prolonged drought in the Gulf States it will be found that rain is often much more likely to occur in the interior than on the immediate coast. This is especially true in hot summer weather. On the immediate lake shore it is generally safe to predict showers on the approach of well-marked low areas, though even this is not an invariable rule.

SUREST CONDITIONS FOR FAIR WEATHER.

There are certain remarkable conditions under which one is always safe to predict fair, even though the skies are very threatening and a strongly marked low area is advancing. These conditions are when a high area of great magnitude moves south or southeast from the northwest and is followed in the extreme northwest by a low area of seemingly great intensity. Often the barometric gradient becomes steep enough to give winds of 40 and 50 miles per hour, and everything betokens a very severe storm. Nevertheless no rain is likely to occur in front of the storm, and this condition will continue until the high area begins to give way and the southerly wind dies down to almost a calm; after that rains may be expected, especially in the lake regions and on the Atlantic coast. This condition, however, must be carefully distinguished from another which at first sight seems analogous, but which gives entirely different results. This is when the high area in front of the storm takes an easterly trend, the winds from the latter are more easterly and cooler, and as a consequence rain immediately begins in the lake regions and persists for a long time, or until the storm has completely passed over, or the high area has finally taken a southerly tendency.

RAIN IN HIGH AREAS OR THE REAR OF STORMS.

A rather remarkable accompaniment of these conditions just described is the occurrence of rain in the rear of the storm. This is one of the safer predictions to make, although seemingly directly contrary to all the principles of forecasting to which one becomes accustomed in the East. In the Atlantic States it is well known that while the storm is still to the westward southerly winds spring up, bringing more or less rain, but after the low area has passed by rather strong and very dry, cold, west, and northwest winds come in and the sky clears almost immediately. On the contrary, in the West, the warm southerly winds are very dry and no rain occurs in front of the storm, while the cold west winds bring on rain which frequently persists even to the center of the high area. It seems probable that the proximity of the Atlantic Ocean in the former case and of the Pacific in the latter may account for these differences. The movement of the clouds in the rear of the western storm is from the Pacific, as may be seen readily on the cloud chart, and this indicates a tendency for moist currents from the Pacific to blow into the rear of the storm. Gen. Greely has suggested that moist currents from Hudson's Bay may also blow to the north of the storm and then circulate to the rear. Many more stations to the north and west will be needed to satisfactorily account for this anomaly. It is well known that in Europe more rain falls in the rear than in the front of storms, and in this case the ocean lies to the westward.

RISING PRESSURE TO THE SOUTH.

Gen. Greely, in "American Weather," has suggested a rule that when the pressure begins rising to the southwest it will shortly clear away in regions toward the northeast, if it has been raining or threatening there. This rule is true in any part of the country, provided there is a sort of spontaneous rise in the pressure; I mean a rise not accompanied by a high area; but if a high area pushes south and the pressure rises on that account, the winds must first get well into the southwest and rather strong before the sky will thoroughly clear.

VERIFICATION OF WEATHER PREDICTIONS.

It is well recognized that in a month where rains are frequent and when they are more or less spontaneous; that is, when they do not accompany well-marked storms, it is very much more difficult to forecast the weather than in other months when there is a strong persistency toward fair weather. The public, however, lose sight of these facts, and are inclined to measure the ability of one in making forecasts by the percentage which is accorded in his month. This may be partially obviated by allowing for the rains in any month. In any case, however, the true method of verifying a prediction would seem to be by experts from the map on which the prediction was based rather than on the resulting weather.

LOCAL FORECASTS.

It seems probable that a wrong impression has gone abroad regarding the errors which arise in making forecasts at the central office in Washington. It is thought by many that serious failures have occurred from neglecting local signs. It can be shown readily that 95 per cent of the errors are due to rapid changes in the greater or more general movements of the atmosphere, and not to the neglect of local causes. These greater movements may be more carefully studied at a central office by experts than by local forecasters at their stations. There is a slight advantage which the local forecaster has, in that he can make his prediction three hours later than the main office, but aside from this there would seem to be a greater advantage at the central office than on station.

H. A. HAZEN,
Professor of Meteorology.

APPENDIX 4.

REPORT OF FORECASTS OF COLD WAVES.

WASHINGTON CITY, *June* 30, 1891.

SIR: I have the honor to report as follows on the prediction of cold waves from October, 1890, to April, 1891.

Cold-wave signals are directed by telegraph from central office in Washington City to be hoisted at various stations throughout the country when the weather map indicates the probable occurrence of a sudden fall in temperature going about as low as freezing point.

Temperature-fall warnings are sent to places by telegraph when the falls anticipated are just on the verge of what would justify a cold-wave warning. No signals are displayed for temperature-fall warnings. They are sent with the weather forecasts, and consist of definite statements of what the fall anticipated will be in degrees and what the temperature will be at its lowest.

A cold-wave warning is considered justified in different ways in different parts of the country.

In the States of Minnesota, North and South Dakota, and Montana a cold-wave signal is justified when there occurs a fall of temperature of 20° or more in twenty-four hours, going to or below 32°.

In the States of Wyoming, Colorado, Kansas, Nebraska, Iowa, Missouri, Wisconsin, Illinois, Michigan, Indiana, Kentucky, Ohio, West Virginia, New York (except New York City and Long Island), western Pennsylvania, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, and Maine a cold-wave signal is justified when the fall of temperature in twenty-four hours is 18° or more and goes to or below 34°.

In New York City and Long Island, eastern Pennsylvania, the District of Columbia, the States of New Jersey, Delaware, Maryland, Virginia, North and South Carolina, Tennessee, Georgia, northern Alabama, northern Mississippi, northern Louisiana, the Indian Territory, Arkansas, and Texas (except a strip of country 100 miles wide along the coast), a cold-wave signal is justified when the fall in temperature in twenty-four hours is 16° and goes to or below 36°, except at Charlotte and Wilmington, North Carolina, Charleston and Columbia, South Carolina, Atlanta and Savannah, Georgia, Montgomery, Alabama, Meridian and Vicksburg, Mississippi, and Shreveport, Louisiana, where a fall of 16°, going only as low as 40°, justifies a cold-wave signal.

In ascertaining whether a cold wave is justified the temperature changes are used occurring in the period of thirty-six hours after the time the signal is ordered hoisted.

A fall of temperature of 22° in thirty-six hours (after reduction for diurnal range of temperature), or a total fall of 28° in forty-eight hours, also justifies the display of a cold-wave signal. There was not a single case last season where this thirty-six-hour and forty-eight-hour condition justified a cold wave, where it was not also justified by the other condition. It is therefore superfluous as a criterion.

A cold wave without signal is where no signal is displayed and a fall of 20° or more in twenty-four hours occurs over 50,000 square miles of country, and the temperature goes to or below freezing point.

A signal is considered "late" when a cold-wave signal is ordered and justified, and a fall in temperature sufficient to justify a signal has occurred at two stations within the United States at least 100 miles apart, in the twelve or twenty-four hours ending with the observation preceding the order. A late signal is given a weight of 75 per cent in verifying signals.

Temperature-fall warnings of 20° or more in twenty-four hours are considered verified when the falls occurring twenty-four hours after the warning are 16° or greater.

The temperature-fall warnings of 10° to 14° are considered justified when the fall in twenty-fours after the warning is 10° or more and the temperature goes below 32°.

The number of cold-wave signals displayed at the various places throughout the country in the different months, the number of signals verified according to the above rules, and the number of severe cold waves without signals are shown in the following table.

During the whole season there were no "late" signals.

COLD-WAVE SIGNALS.

Stations.	Nov., 1890.		Dec., 1890.		Jan., 1891.		Feb. 1891.		Mar. 1891.		Total.		Severe cold waves without signals.
	Displayed.	Verified.	Displayed.	Verified.	Displayed.	Verified.	Displayed.	Verified.	Displayed.	Verified.	Displayed.	Verified.	
Portland, Me	...	...	2	2	5	1	3	2	1	...	11	5	4
Boston, Mass	...	...	2	2	5	2	3	2	1	...	11	6	4
Manchester, N. H	...	...	1	1	5	2	3	2	1	...	10	5	5
New London, Conn	...	...	2	2	2	1	3	2	1	...	8	5	2
New Haven, Conn	...	...	2	2	2	1	3	2	1	...	8	5	2
Albany, N. Y	1	1	1	1	4	2	4	3	1	...	11	7	5
New York City, N. Y	...	...	2	2	2	1	3	3	...	...	7	6	...
Harrisburg, Pa	...	...	1	...	2	...	3	3	...	...	6	3	1
Philadelphia, Pa	...	...	1	1	2	1	3	3	...	...	6	5	...
Baltimore, Md	...	...	2	...	2	1	3	3	...	...	7	4	1
Washington City	...	...	2	1	2	1	3	3	...	...	7	5	...
Lynchburg, Va	...	...	2	1	2	1	4	4	...	...	8	6	1
Richmond, Va	...	...	...	...	2	...	3	3	...	...	5	3	...
Norfolk, Va	...	...	2	1	2	1	4	4	...	...	8	6	1
Charlotte, N. C	...	...	2	...	2	1	4	4	...	...	8	5	1
Raleigh, N. C	...	...	2	...	2	1	5	5	...	...	9	6	1
Wilmington, N. C	...	...	1	...	1	1	5	3	...	...	7	4	...
Charleston, S. C	...	...	1	...	1	1	5	2	1	1	8	4	...
Columbia, S. C	...	...	1	...	2	1	4	3	...	...	7	4	...
Augusta, Ga	...	...	1	...	1	1	5	3	1	1	8	5	...
Savannah, Ga	...	...	1	...	1	1	3	1	1	...	6	2	...
Atlanta, Ga	...	...	1	...	2	1	4	2	1	1	8	4	1
Montgomery, Ala	...	...	1	...	1	1	3	1	1	...	6	2	...
Vicksburg, Miss	...	...	2	1	2	...	3	3	1	1	8	5	...
Oxford, Miss	...	...	1	...	2	1	5	4	3	1	11	6	...
New Brunswick, Mo	...	...	2	2	2	1	3	3	...	...	7	6	...
Meridian, Miss	...	...	2	1	2	1	3	3	1	1	8	6	...
Shreveport, La	...	...	2	1	2	1	5	3	1	1	10	6	...
Fort Smith, Ark	...	...	2	2	1	...	5	4	2	2	10	8	...
Little Rock, Ark	...	...	1	1	2	1	5	3	3	3	11	8	...
Abilene, Tex	...	...	2	1	1	...	4	4	1	1	8	6	1
Memphis, Tenn	1	...	2	1	2	1	5	4	3	2	13	8	...
Nashville, Tenn	1	...	2	1	2	1	5	3	3	2	13	7	1
Knoxville, Tenn	...	...	2	...	2	2	6	4	1	...	11	6	2
Chattanooga, Tenn	...	...	2	...	2	2	6	4	1	1	11	7	2
Louisville, Ky	1	...	2	...	2	1	7	4	2	...	14	5	...
Indianapolis, Ind	2	1	2	1	2	1	5	3	3	1	14	7	...
Cincinnati, Ohio	1	...	2	1	2	1	6	4	2	...	13	6	1
Lexington, Ky	1	...	2	1	1	1	...	...	...	...	4	2	...
Columbus, Ohio	1	...	1	...	2	1	6	5	2	1	12	7	...
Parkersburg, W. Va	1	...	2	...	2	1	5	5	2	...	12	6	4
Pittsburg, Pa	...	...	2	1	2	1	5	4	2	...	11	6	4
Oswego, N. Y	1	1	1	1	3	2	4	3	...	...	9	7	...
Rochester, N. Y	1	1	1	1	2	2	5	3	...	...	9	7	2
Ithaca, N. Y	1	1	1	1	2	2	5	3	...	...	9	7	2
Buffalo, N. Y	1	1	1	1	2	1	5	3	...	...	9	6	1
Erie, Pa	1	...	1	1	2	1	4	1	...	...	8	3	...
Cleveland, Ohio	2	...	1	...	2	1	5	2	...	...	10	3	...
Sandusky, Ohio	2	...	1	...	2	1	6	2	1	...	12	3	...
Toledo, Ohio	2	...	1	1	2	1	6	2	1	...	12	4	...
Detroit, Mich	1	1	1	1	2	1	5	2	1	...	10	5	...
Port Huron, Mich	1	1	1	1	2	1	5	2	1	...	10	5	...
Lansing, Mich	1	1	1	1	2	1	4	2	1	...	9	5	...
Alpena, Mich	...	...	1	1	2	2	6	4	1	...	10	7	...
Sault St. Marie, Mich	...	...	1	1	2	1	5	3	1	1	9	6	...
Marquette, Mich	...	...	2	2	2	1	5	3	3	1	12	7	...
Green Bay, Wis	1	...	2	2	3	3	5	4	3	1	14	10	...

COLD WAVE SIGNALS—Continued.

Stations.	Nov., 1890.		Dec., 1890.		Jan., 1891.		Feb., 1891.		Mar., 1891.		Total.		Severe cold waves without signals.
	Displayed.	Verified.	Displayed.	Verified.	Displayed.	Verified.	Displayed.	Verified.	Displayed.	Verified.	Displayed.	Verified.	
Chicago, Ill	1	...		2	3	....	6	3	3	1	16	6	1
Duluth, Minn	1	...	2	2	1	1	4	3	2	....	10	6	1
St. Paul, Minn	1	...	2	2	2	1	4	3	2	1	11	7	3
La Crosse, Wis	1	...	2	2	2	2	4	3	2	....	11	7	1
Dubuque, Iowa	1	...	3	2	3	1	4	4	3	3	14	10	2
Davenport, Iowa	1	...	3	2	3	....	4	2	3	3	14	7	3
Des Moines, Iowa	1	...	2	2	3	2	4	3	2	2	12	9	3
Keokuk, Iowa	1	...	3	2	3	2	5	4	2	3	15	11	1
Springfield, Ill	2	1	2	1	2	1	6	4	3	2	15	9	1
Cairo, Ill	1	...	3	1	1	1	6	4	4	3	15	9	....
St. Louis, Mo	2	1	3	2	2	....	6	5	3	2	16	10	1
Columbia, Mo	1	...	2	2	2	1	5	4	2	2	12	9	....
Springfield, Mo	1	..	1	1	1	1	6	5	2	2	11	9	1
Kansas City, Mo	1	...	2	2	2	1	5	4	2	2	12	9	1
Wichita, Kans	1	...	2	1	1	1	5	4	2	1	11	7	2
Concordia, Kans	1	...	1	....	2	1	4	3	1	....	9	4	3
Milwaukee, Wis	1	...	2	2	3	1	5	2	3	1	14	6	....
Omaha, Nebr	1	...	2	2	3	3	3	3	1	1	10	9	5
Sioux City, Iowa	1	...	2	2	3	2	3	3	....	....	9	7	4
Valentine, Nebr	1	1	2	2	3	2	1	....	....	....	7	5	6
Yankton, S. Dak	1	...	2	2	3	2	3	3	....	....	9	7	3
Crete, Nebr	1	...	2	2	2	2	3	3	1	1	9	8	2
Leavenworth, Kans	1	...	2	2	2	1	5	4	2	2	12	9	1
Topeka, Kans	1	..	1	....	2	1	5	4	1	1	10	6	1
Huron, S. Dak	...	...	2	2	2	2	1	1	....	....	5	5	5
Moorhead, Minn	...	...	2	2	1	1	1	1	....	....	4	4	11
St. Vincent, Minn	...	...	2	2	....	....	....	....	....	....	2	2	....
Rapid City, S. Dak	1	1	2	2	2	2	....	....	....	....	5	5	6
Cheyenne, Wyo	1	...	1	1	1	1	....	....	....	....	3	2	3
North Platte, Nebr	1	...	1	1	2	1	2	1	1	....	7	3	6
Denver, Colo	1	1	1	....	....	....	1	....	1	1	4	2	2
Pueblo, Colo	1	1	1	1	....	....	1	....	1	1	4	3	2
Dodge City, Kans	1	...	2	1	1	1	4	3	1	....	9	5	2
Red Wing, Minn	1	...	3	2	2	....	4	4	2	1	12	7	2
Minneapolis, Minn	1	...	3	2	2	....	4	3	2	1	12	6	2
Grand Haven, Mich	1	1	2	1	1	....	5	2	....	....	9	4	....
Oklahoma, Ind. T	...	...	....	....	1	....	2	2	2	2	5	4	1
Total	60	16	158	103	188	101	378	266	114	62	898	548	137

Below is given a summary of the cold-wave signals displayed in the various months and the temperature-fall warnings.

In the summary is also given the temperature falls greater than 12 degrees occurring during the display of cold waves, but which are not verified on account of being short of the verifying temperature or the requisite amount of fall. Though these are not verified according to the strict rule, practically considered they are not in every case bad failures as cold-wave warnings. When the temperature is below 32°, announcements of falls of 12° or even 10° are very important.

SUMMARY OF COLD-WAVE SIGNALS, SEASON OF 1890-'91.

	1890.			1891.				Total.
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	
Cold-wave signals hoisted	0	60	158	188	378	114	0	898
Cold-wave signals verified	....	16	103	101	266	62	....	548
Percentage of verification	....	26.7	65.2	53.7	70.4	54.4	....	61.1
Severe cold waves without signals	....	0	64	9	44	20	0	137

TWENTY-FOUR HOUR TEMPERATURE FALLS WHILE COLD-WAVE SIGNALS WERE DISPLAYED, BUT NOT VERIFIED.

26° falls	....	1	......	......	1	......	.....	2
24° falls	....	1	......	......	2	......	.....	3
22° falls	....	1	......	......	......	......	.....	1
20° falls	....	3	......	......	2	......	.....	5
18° falls	....	3	......	2	3	1	.....	9
16° falls	....	2	5	7	12	7	.....	33
14° falls	....	4	6	7	13	6	.....	36
12° falls	....	4	6	4	18	7	.....	39

TEMPERATURE-FALL WARNINGS.

Number of warnings	0	6	119	119	103	74	16	437
Warnings verified	....	6	73	59	50	26	6	220
Percentage of verification	....	100.0	61.3	49.6	48.5	35.1	37.5	50.4

Temperature warnings in place of cold-wave warnings is an innovation designed to reduce the number of cold-wave signals displayed, and yet give due notice to the public of any important temperature falls. The plan worked satisfactorily the past season. The number of cold-wave signals, 898, is less than that for the years preceding, being 1,298 in 1889-'90 and 1,538 in 1888-'89.

Giving the temperature-fall warnings half weight as compared with cold-wave warnings the percentage of verification of both combined for season 1890-'91 is 59.5. The percentages separately are for cold waves 61.1 and for temperature falls 50.4.

In the cases of failure of verifications of temperature-fall warnings on account of insufficient fall, many of the warnings come within a degree or two of being verified.

The percentage of verification of cold waves for 1889-'90 was 55; for 1888-'89 it was 56.8.

If all the cold-wave signals were considered verified by a fall as small as 14°, the percentage of verifications for 1890-'91 would be 71.3.

The number of cases of cold waves without signals, 137, was very large during the past season. The number at 6 places in New England was 22, and at 30 places west of the Mississippi River, 84.

The total number of places for which warnings are issued is 94. East of the Mississippi at 48 places there were 31 cases of occurrence of cold waves without any signals displayed. Most of the cases of cold waves without signals were in the Northwest in the States of Minnesota, North and South Dakota, and Nebraska. At Moorhead, Minn., for instance, there were 11 during the season.

The great number of failures in this region is due to the small area of country to the north and west of it under observation. For a great part of this region it would be well not to attempt the prediction of cold waves.

A fall of 20° in twenty-four hours for the region of Dakota is altogether too small to be considered a cold wave. The number of such falls in winter is very large.

The proposed method for prediction of cold waves from weather maps, described in the last annual report, was partially used during the season's work of forecasting. The most useful part was found to be the method of finding the amount of temperature fall at the place of greatest fall. The other parts of the method could not be used conveniently on account of the difficulties in the way of making measurements of the maps.

In the cases of great cold waves the telegraph lines are often down and the reports get in late, so that the weather maps are often incomplete at the time the forecasts must be issued. The measurements of maps, however, made in the special cases of cold waves in deriving the method were of great use in training the eye to judge with some approach to accuracy regarding the extent of "high" or "low" and the density of the isothermal lines, which are the factors in determining the extent and density of cold waves.

The investigation of cold waves was not continued during the year and nothing new was developed, my time being taken up in work pertaining to derivation of practical rules for the prediction of river stages, in addition to routine work of the river and flood division.

Very respectfully,

T. RUSSELL.

Gen. A. W. GREELY,
Chief Signal Officer.

APPENDIX 5.

REPORT OF PROFESSOR IN CHARGE OF THE RIVER AND FLOOD DIVISION.

WASHINGTON CITY, *June* 30, 1891.

SIR: I have the honor to make the following report on the work of the river and flood division of the Signal Office for the year ended June 30, 1891.

The $4,000 increase in the appropriation for the river and flood division the past year permitted of establishing a large number of new river stations. The new stations were mainly located in Alabama, Georgia, South Carolina, North Carolina, Virginia, and Pennsylvania.

The number of special river stations of the United States Weather Bureau now in operation is one hundred and nine. Observations of rainfall are made. River stages are observed daily in most cases the year round, in some cases for only part of the year. In addition to these, regular meteorological stations to the number of twenty-seven take river observations.

The river stages to feet and tenths are sent mostly by telegraph to the various parts of the country interested in the information. In a few instances the reports are sent by mail.

The stations are as follows, arranged according to the various sections and the centers having control; the Weather Bureau observer at section center is in charge of all the river stations in section:

LIST OF SPECIAL RIVER STATIONS ARRANGED ACCORDING TO SECTIONS.

Center of section.	Name of station.
Augusta Ga	
Bismarck, N. Dak.	
Brownsville, Tex.*	Eagle Pass, Tex.
	Laredo, Tex.
Cairo, Ill.	Charleston, Tenn.
	Clinton, Tenn.
	Columbia, Tenn.
	Decatur, Ala.
	Evansville, Ind.
	Johnsonville, Tenn.
	Mount Carmel, Ill.
	Mount Vernon, Ind.
	Paducah, Ky.
	Vincennes, Ind.
	Terre Haute, Ind.
Charleston, S. C.*	Camden, S. C.
	Cheraw, S. C.
	Columbia, S. C.
	Effingham, S. C.
	Mount Holly, N. C.
	Nichols, S. C.
	Tiller's Ferry, S. C.
	Wateree on Congaree, S. C.
	Wateree on Wateree, S. C.
Chattanooga, Tenn.	Canton, Ga.
	Kingston, Tenn.
	Loudon, Tenn.
	Resaca, Ga.
Chattanooga, Tenn.	Rockwood, Tenn.
	Rome, Ga.
	Strawberry Plains, Tenn.
Cincinnati, Ohio	Catlettsburg, Ky.
	Charleston, W. Va.
	Circleville, Ohio.
	Falmouth, Ky.
	Frankfort, Ky.
	Hinton, W. Va.
	Louisa, Ky.
	Marietta, Ohio.
	Pt. Pleasant, W. Va.
	Portsmouth, Ohio.
	Wheeling, W. Va.
	Zanesville, Ohio.
Davenport, Iowa	
Dubuque, Iowa	
Harrisburg, Pa	Huntingdon, Pa.
	Lock Haven, Pa.
	Wilkes Barre, Pa.
Kansas City, Mo	Manhattan, Kans.
	Plattsmouth, Nebr.
	St. Joseph, Mo.
Keokuk, Iowa	
Knoxville, Tenn	
La Crosse, Wis	
Little Rock, Ark	Dardanelle, Ark.
Louisville, Ky	
Memphis, Tenn	Helena, Ark.

* No observations.

LIST OF SPECIAL RIVER STATIONS ARRANGED ACCORDING TO SECTIONS—Cont'd.

Center of section.	Name of station.	Center of section.	Name of station.
Montgomery, Ala...	Childersburg, Ala.	Pittsburg, Pa......	Warren, Pa.
	Claiborne, Ala.		Weston, W. Va.
	Columbus, Miss.		West Newton, Pa.
	Cordova, Ala.	Portland, Oregon..	
	Florence, Ala.	Raleigh, N. C.*....	Clarksville, Va.
	Gadsden, Ala.		Danville, Va.
	Sturdevant, Ala.		Fayetteville, N. C.
	Tallassee, Ala.		Weldon, N. C.
	Tuskaloosa, Ala.	Shreveport, La....	Arthur City, Tex.
	Warrior, Ala.		Coushatta, La.
Nashville, Tenn	Burkesville, Ky.		Fulton, Ark.
	Burnside, Ky.	Sioux City, Iowa..	Pierre, S. Dak.
	Carthage, Tenn.	St. Louis, Mo	Alton, Ill.
New Orleans, La....	Alexandria, La.		Arlington, Mo.
	Camden, Ark.		Beardstown, Ill.
	Delhi, La.		Boonville, Mo.
	Girard, La.		Cape Girardeau, Mo.
	Melville, La.		Chester, Ill.
	Monroe, La.		Hermann, Mo.
Omaha, Nebr.......			Le Claire, Iowa.
Parkersburg, W. Va.			Louisiana, Mo.
Pittsburg, Pa.......	Brookville, Pa.		Peoria, Ill.
	Clarion, Pa.		Warsaw, Ill.
	Confluence, Pa.	St. Paul, Minn	
	Freeport, Pa.	Vicksburg, Miss...	Arkansas City, Ark.
	Greensboro, Pa.		Newport, Ark.
	Johnstown, Pa.		Yazoo City, Miss.
	Lock No. 4, Pa.	Washington, D. C.	Harpers Ferry, W. Va.
	Mahoning, Pa.		
	Morgantown, W. Va.		Muscatine, Iowa.
	Oil City, Pa.		Washington and Virginia Long Bridge.
	Parkers Land'g, Pa.		
	Rowlesburg, W. Va.		
	Saltsburg, Pa.		

* No observations.

The number of new river stations established during the year was thirty-eight; two stations, Grand Tower, Ill., and Eddyville, Ky., were discontinued during the year. The new stations are: In Mississippi, Columbus; in Alabama, Claiborne, Tuskaloosa, Cordova, Warrior, Childersburg, Gadsden, Sturdevant, Tallassee, and Florence; in Georgia, Resaca, Rome, and Canton; in Kentucky, Burkesville; in Texas, Laredo, Eagle Pass, and Arthur City; in Pennsylvania, Huntingdon, Lock Haven, Wilkes Barre, and West Newton; in Illinois, Alton and Chester; in Missouri, Cape Girardeau; in Virginia, Long Bridge, Danville, Clarksville; in North Carolina, Fayetteville and Weldon; in South Carolina, Camden, Wateree on the Wateree, Wateree on the Congaree, Effingham, Tillers Ferry, Cheraw, and Nichols; in South Dakota, Pierre; in North Dakota, Bismack.

There were nine special rainfall stations established during the year and one, that at Tracy, Minn., discontinued.

The total number of special rainfall stations now reporting is fifty.

SPECIAL RAINFALL STATIONS.

Shreveport section.—Arkadelphia, Ark.

Cairo section.—Lafayette, Ind.; Logansport, Ind.; Greensburg, Ky.; Bowling Green, Ky.

Chattanooga section.—Rogersville, Tenn.; Murphy, N. C.; Asheville, N. C.; Charleston, N. C.

Cincinnati section.—Kenton, Ohio; Mansfield, Ohio; Wooster, Ohio; Canton, Ohio; Abingdon, Va.; Caledonia, Ohio; Christiansburg, Va.; White Sulphur Springs, W. Va.; Glenville, W. Va.; Buckhannon, W. Va.

Dubuque section.—Portage, Wis.

Fort Smith section.—Springer, N. Mex.; Eufaula, Ind. T.; Tulsa, Ind. T.
Keokuk section.—Cedar Rapids, Iowa.
La Crosse section.—Chippewa Falls, Wis.; Phillips, Wis.; Medford, Wis.
Kansas City section.—Culbertson, Nebr.; Oberlin, Kans.; Kirwin, Kans.; Wallace, Kans.; Salina, Kans.
Louisville section.—Rushville, Ind.; Humtingdon, Ind.; Sidney, Ohio.
Nashville section.—Williamsburg, Ky.
St. Louis section.—Ottawa, Ill.
St. Paul section.—Fergus Falls, Minn.; Fort Ripley, Minn.; Ortonville, Minn.; Alexandria, Minn.; Redwood Falls, Minn.
Washington section.—Woodstock, Va.; Gettysburg, Pa.; Cumberland, Md.
Montgomery section.—Lynn, Ala.; Talladega, Ala.
Pittsburg section.—New Castle, Pa.; Ridgway, Pa., Stoyestown, Pa.; Dubois, Pa.
Raleigh section.—Oak Ridge, N. C.; Chapel Hill, N. C.; Lillington, N. C.

Anderson, S. C.; and Elberton, Ga., voluntary stations, report excessive rainfalls to Augusta, Ga., without compensation.

The new stations established during the year are Lynn and Talladega, Ala.: Newcastle, Ridgway, Stoyeston, and Dubois, Pa.; Oak Ridge, Chapel Hill, and Lillington, N. C.

Telegraphic reports of the stage of water are received daily at the Washington office from the following places: Shreveport, La.; Fort Smith and Little Rock, Ark.; Sioux City, Iowa; Omaha, Nebr.; Kansas City, Mo.; St. Paul, Minn.; La Crosse, Wis.; Dubuque, Iowa; Davenport, Iowa; Keokuk, Iowa; St. Louis, Mo.; Cairo, Ill.; Memphis, Tenn.; Helena, Ark.; Vicksburg, Miss.; New Orleans, La; Pittsburg, Pa.; Parkersburg, W. Va.; Cincinnati, Ohio; Louisville, Ky.; Chattanooga and Nashville, Tenn., and Augusta, Ga.

During the time of high water in the Ohio and Mississippi rivers telegraphic reports in addition to those from the above places were received daily from Charleston, W. Va.; Louisa, Ky.; Circleville, Ohio; Evansville, Ind.; Paducah, Ky.; Newport, Ark.; Arkansas City, Ark; and Greenville, Miss.

Definite predictions of high water were made, which were fairly well verified by the stages subsequently occurring.

The following were the principal predictions and the actual stages:

Feb. 2.—At Cincinnati the river will rise to 45 feet by the 5th (actual stage, 47.6 feet on 5th).

Feb. 4.—At Evansville, Ind., the river will rise to 38 feet by the 8th (actual stage, 38.5 on the 8th, crest, 39.1 on 10th); at Mount Vernon, Ind., river will rise to 41 feet by the 8th, (actual stage, 37.2, crest, 38.1 on 10th); at Cairo the river will rise to 39 feet by February 11, (actual stage, 39.2).

Feb. 18.—At Wheeling the river will rise to 47 feet by the 19th (actual, 44.6); at Parkersburg to 50 feet by the 20th (actual, 44.3 on 20th, crest, 44.6 on 21st.

Feb. 20.—At Cincinnati the river will rise to 50 feet by the 24th (actual, 56.7); at Louisville to 26 feet by the 25th (actual, 30.1 on 25th; crest, 32.2 on the 27th); at Evansville to 41 by February 28 (actual, 42.6; crest on March 2, 42.8); at Mount Vernon, Ind., to 43 feet by the 28th (actual, 43.1; crest, 44.1 on March 3). The large error in Cincinnati stage was due to the reports from Charleston and Louisa being late. The prediction was based on estimated readings that were too low.

Feb. 21.—At Cincinnati the river will rise to 54 feet by the 24th (actual, 56.7).

Feb. 23.—At Vicksburg the river will rise to 43.4 feet by March 2 (actual, 43.8).

Feb. 24.—At Cairo the river will rise to 47 feet by March 3 (actual, 46.1).

The following special river bulletins were issued:

SPECIAL BULLETIN.

WASHINGTON CITY, *February* 25, 1891—11:30 a. m.

High water is impending in the Mississippi River below Cairo. The highest water, 57.3 feet, occurs at Cincinnati to-day, February 25, there having been a rise of 16 feet in the past six days.

The Upper Ohio, the Kanawha, and Big Sandy rivers are falling. The Arkánsas River is stationary, at a medium stage.

The Tennessee is at a stage of 29 feet at Chattanooga, a rise of 13 feet in four days. The Cumberland at Nashville is 24.4 feet, a rise of 3 feet in three days. At St. Louis there has been a rise of 5 feet in one day. At Cairo the stage of water is 44.3 feet and rising. By March 3, a stage of 47.5 feet may be expected at Cairo (actual stage, 46.1; crest, 46.2).

A comparison with the high stages of previous years shows that the following stages may be expected at places along the lower river: Memphis, 34 feet by March

6 (actual, 34); Greenville, 40 feet (actual, 40.2); Helena, 43 feet by March 7 (actual, 42.9); Arkansas City, 45 feet by March 8 (actual, 45.4); Vicksburg, 46 feet by the 10th (actual, 46.1); Baton Rouge, 34 feet by the 12th.

A cold wave is sweeping over the country from the West, and it is not likely that rain to any considerable amount will fall in the Ohio valley in the next few days.

SPECIAL RIVER BULLETIN.

WASHINGTON CITY, *April* 2, 1891—4 p. m.

The late general rains will, it is probable, have but little effect in the Lower Mississippi River. It is estimated that the river at Cairo will rise about a foot and a half in the next week, carrying the stage of water there to about 45 feet. This can scarcely maintain the present high stage of water in the lower river (48 feet at Vicksburg), and it is likely that the further rise there, if any, will not be more than a few tenths of a foot.

At Cairo the stage reached April 9 was 44.3 feet; it was 44.8 on the 6th. There was very little or no subsequent rise at Vicksburg, the highest stage, April 3, being 48.1 feet. The high stage of 48 feet continued at Vicksburg until April 12.

There was general satisfaction with the river predictions the past year. The following is an extract of a letter from the owner of the Evansville, Ind., Journal:

FEBRUARY 21, 1891.

I want to thank you for your prompt telegrams and more especially for bulletins in time of danger.

Our people are placing more confidence in the Signal Service, both as to weather and river reports. Most of the stock and property along the banks has been removed and there is no excuse for owners who lose anything, for the warnings of the department have given them plenty of time.

JNO. H. MCNEELY.

During the high water along the Lower Mississippi River special reports were for a time furnished from a number of places to the engineers in charge of the levees and to various interested communities in the threatened district.

There was very little damage done by the high water in the Lower Mississippi Valley. Very few breaks in the levees occurred. A crevasse 50 feet wide occurred in Concord levee, East Carroll Parish, La., March 21; the Ames crevasse opposite New Orleans was 400 feet wide. A break in levee 200 feet wide occurred at Longwood, 30 miles south of Greenville, Miss., April 4.

During the year there was prepared in the river and flood division by milliographic process the "Stages of the Mississippi River and of its principal tributaries, except the Ohio River, 1860 to 1889, inclusive, Part II," containing 523 pages, and also "Stages of water at miscellaneous river stations in California, Oregon, North Carolina, etc., 1875 to 1889, inclusive, Part III," containing 143 pages.

Forty-four copies of each were produced. The copies have been distributed to a number of Signal Service stations, to a few important public libraries in the region of the stations, and to various engineer offices, to the Mississippi River Commission, and to the Missouri River Commission.

The volumes of river stages, Parts I, II, and III, contain all the river stages observed by the Signal Service up to January 1, 1890, except at places for which the stages have already been printed by the Mississippi River Commission.

The very considerable work of arranging, copying, typewriting, and milliographing the river stages and searching the records for notes of bench-marks, heights, changes of gauge zeros, etc., was all done in the river and flood division by Miss Carrie M. Cooke, Mr. W. D. Porter, and Mr. George C. King.

Progress was made during the year in deriving from the back records of river stages practical rules for the prediction of flood stages at various places from the stages observed at points on the river above them. The rules with the principal stages and changes on which they are based are given in the paper herewith submitted.

The rules are empirically derived according to graphical processes, the stages and rises at a place during the occurrence of freshets being compared with the stages and rises just preceding at points farther up the river. A principle used was that a rise of a certain number of feet at an upper station has greater power to produce a rise at points lower down the stream—the greater the stage at the upper point; and that the higher the water stages at lower points the less efficient will the rises at the upper stations be in producing rises at points lower down. The measure of efficiency arbitrarily adopted was to consider it proportional to the rise multiplied by the average stage at the place during the rise. No doubt it would be more accurate, and the rules for predicting rises could be somewhat improved by considering the efficiency proportional to the rise multiplied by the mean stage plus a constant for each place.

The zeros of the Weather Bureau river gauges are all very nearly at the level of low water for the places, usually within a foot or less.

The relative effects of rises in various tributaries in producing a rise at a point lower down were ascertained by trying first one series of coefficients and then another until one was found to satisfy tolerably well all the observations of rises during the time for which there are records of stages. The relative effects of different rivers, it might be supposed, would be nearly proportional to their drainage areas. This, however, was not found to be very closely the case. The average slopes of the ground in drainage basins and the permeability of soil determine largely the relative effect of rivers in producing floods.

In paper submitted herewith, prepared during the year, is given a list of the places, dates, and amounts of rainfall in 24 hours greater than 4 inches. These, about 1,640 in number, chronologically arranged have been taken principally from the Monthly Weather Review.

An increase in the number of river stations being authorized by the increased appropriation for the river and flood division the past year, in order to ascertain the regions of the country best entitled to river gauges, the regions most subject to overflow being considered to be such, a catalogue was made of all the floods noted in the issues of the Monthly Weather Review since the commencement of the Signal Service. The paper is on file in manuscript in the river and flood division.

Extracts given in paper submitted herewith were made of all the principal results of measurements of river discharges given in the annual reports of the Chief of Engineers, U. S. Army, and also other information of value from the reports and other sources relating to rivers. This will be of service in the work of predicting river stages.

Rainfall observations at present are of very little value in river-stage predictions. An investigation has been begun to determine just exactly what use can be made of them. Only slight progress has as yet been made on the work. A chart of the Mississippi Valley above Cairo, and another of the valley between Cairo and Vicksburg, were prepared, on a scale of $\frac{1}{2000000}$, showing lines of equal water travel by river to Cairo and Vicksburg by all the large water-courses in basins. The lines are one day apart. One of the maps extends about fourteen days from Cairo on the east and eleven days on the west. This comprises all the Ohio Valley, the Missouri Valley to Omaha, and the Upper Mississippi to St. Paul. In establishing the lines of equal travel a velocity of water was adopted equal to the velocity of the Ohio River at Paducah, Ky., at an average stage of the river. Some fraction of the rain that falls in the areas of country between successive travel lines reaches Cairo at approximately the same time. The rain in successive areas reaches Cairo approximately on successive days.

The areas between successive day travel lines on the map are divided into minor areas according to drainage basins and other features of the map. These areas, about 104 in number, have been measured with a planimeter. They vary from a few hundred square miles in area in some cases to 2,830 in others.

The map contains the names of all the Weather Bureau meteorological stations, all the special river and rainfall stations, and a selected number of voluntary rainfall stations as nearly as possible equally distributed over the country, taking only such as are now in operation and have a record extending over at least two years. There are in all about 450 stations on the map in the drainage areas under consideration.

It is proposed to plot every daily rainfall on maps of this kind, a map being taken for each day beginning with 1882, the year of great flood in the Lower Mississippi Valley.

The rainfalls of all the special river and rainfall stations from the opening of the stations up to January, 1891, have been tabulated, 1 page to a year, on form No. 174, and comprise 1,348 pages. The rainfall of voluntary stations has not yet been arranged and only very little of the rainfall at any of the places has as yet been plotted on the maps.

By the plan of investigation adopted it is expected to ascertain the relations between the quantity of rainfall, its distribution in time and space, and the subsequently occurring stages of water at Cincinnati, Cairo, St. Louis, and Vicksburg. These relations will be of use in connection with the river-stages in estimating high stages of water in the future in the case of excessive or widely extended rainfalls and show just to what extent rainfalls can be made useful in flood predictions.

The prediction of river stages at a place from the observed gauge readings at places farther up the river can not be made with any very great accuracy on account of the water entering the river between the gauge stations. The probable error of a predicted stage at Cairo according to the rule for predicting now in use is about ± 1.2 feet. The largest error ever likely to occur may be taken as about 3 feet. Above Cairo there is an area of 108,000 square miles, the drainage water from which passes Cairo but does not pass St. Louis, Cincinnati, Chattanooga, or Nashville. On the gauge readings at those places the prediction for Cairo depends.

The rule derived for finding the Cairo stage from the stages preceding it at the places above it represents what occurs in the average of cases. When the main part of rainfall producing a rise at Cairo is in the drainage area above Cincinnati, the rule for finding the Cairo stage will give the computed stage too high; when the greater part of rainfall is below Cincinnati, the computed Cairo stage will be too low. By means of the investigation indicated it is expected that it will be possible to introduce a correction to a computed stage depending on the location, the extent, and depth of the rainfall areas concerned in producing the rise.

The plan for further improvement of river-stage predictions also contemplates the gauging of rivers, that is, the determination of the quantity of water in cubic feet per second passing a place for various stages of the river from the highest to the lowest.

In the act of Congress creating the Weather Bureau "the gauging and reporting of rivers" is expressly authorized. The estimate for the river and flood division of the Weather Bureau in the appropriation for this year was $17,000. Of this sum $4,000 was intended to be applied to the expenses of making discharge measurements of rivers. It is recommended that this sum, or such part as it may be deemed advisable to apply to river gauging, be used entirely in measuring the discharges of the important tributaries of the Ohio River, the Wabash, Green, Kentucky, Big Sandy, and the upper Ohio at Cincinnati, Parkersburg, and Pittsburg. The discharge of the Kanawha River at Charleston, W. Va., is now known for a large range of water stages, and also that of the whole Ohio River at Paducah, Ky.

It is considered that it will be sufficient for flood-prediction purposes to obtain discharge measurements of these rivers for stages about 10 feet apart in elevation. About four days' work of a gauging party will be required at each stage from low to high water. The measurements will necessarily extend over several years. The work will require to be done as the stages occur. It will take about twenty days work of a gauging party for each station exclusive of the work of computation of results.

The advantage to be derived from discharge measurements is that practical rules for flood-stage predictions and better ones can be established with a shorter record or river stages at a place than is now the case, where the rules are derived with reference to stages and changes only and without any reference to the quantity of water passing a place. The quantity varies very greatly in different rivers for like river stages. It requires a long series of years' observations of water stages with rises sometimes in one tributary and sometimes in another, or in two or more of them at the same time, in order to disentangle the effect of the various rises, and estimate the flood-producing effects of each stream separately.

The plan of river gauging proposed is to have the work done by local engineers, paying a stated sum per day depending on the number of men employed and the kind of boat used in the work, and depending on the extent and nature of the stream to be gauged. The difficulty of measuring a cross section and determining the water velocity will be very different in different rivers. Where a river is not navigated the method of stretching a cable across the stream and lowering the meter gauge into the water at points 10 to 20 feet apart along the line will probably be the best and most economical way of working. Where there is a bridge across a river, sufficiently good results for velocity of water can probably be obtained by lowering the meter gauge from the bridge.

Anchors, cables, and in some instances steam launches will be required to prosecute the work of river gauging successfully.

The meter gauges should be furnished from this office and should all be of one pattern, the propeller-wheel variety with electric break circuit and self-register. The standardizing of the meter gauges by dragging at various velocities through the quiet water of a pond or reservoir should be done at Washington City.

On some streams or at some points sufficiently good measurements can possibly be obtained by establishing two staff gauges several miles apart on a straight stretch of river and leveling between them. Simultaneous readings of the gauges will give the surface slope of river from which in connection with the area of cross section the velocity can be derived. The velocity and the area of a cross section give the discharge.

It will be necessary to have the various locations where it is proposed to make measurements visited by a person to decide on the best method of doing the work and to select competent engineers who will be in readiness when the stages occur at which measurements are desired.

More than the usual amount of routine work was done in the river and flood division during the past year. This consisted in the answering of letters of inquiry in regard to river stages, floods, etc., letters of instructions to observers in regard to observations, the opening of new stations, the sending of reports, etc., the examination of monthly forms of river and rainfall, the plans and correspondence relating to the opening of new stations and the building of river gauges.

Very respectfully,

T. RUSSELL,
Professor in charge of River and Flood Division.

Gen. A. W. GREELY,
Chief Signal Officer.

BOUNDARIES OF CATCHMENT BASINS

Appendix 5.
Chief Signal Officer.

PRACTICAL RULES FOR PREDICTION OF FLOOD STAGES OF RIVERS IN THE UNITED STATES.

By T. RUSSELL, *Professor, U. S. Weather Bureau.*

To the river and flood division of the Weather Bureau is assigned the very important duty of predicting the rises to flood stages in rivers over the whole United States. The predictions are made on the basis of observations of rainfall and river stages at Weather Bureau stations throughout the country.

No definite and detailed instructions as to what methods or rules are to be followed in making the predictions have ever been furnished to the person in charge of the work. A necessary preliminary, therefore, to the making of predictions of any value is to devise trustworthy rules for the purpose.

Daily observations of river stages have been made at a large number of places for a great many years. No attempts, however, that the writer is aware of, have ever been made to utilize the records in determining rules for river predictions. This was undertaken by the writer on being put in charge of the river and flood division of the Signal Office by Gen. A. W. Greely in May, 1889. The rules for prediction of river stages given here are the results of the work as far as it has been carried.

From the low velocity with which water travels, rolling down the sloping bed of a stream at the rate of 2 to 4 miles an hour, as a ball rolls down an inclined plane, it is manifest that some idea can be formed of the height the water will attain at a place if the height for a point upstream from the place is known. At Cincinnati, for instance, the stage of river is nearly the result of the stage three days before at Parkersburg, W. Va.

A high stage of water such as 50 feet at Parkersburg, however, is not always followed by a perfectly definite high stage at Cincinnati three days later, because of the variable quantity of water coming into the river between the two places at different times, and because of the rainfall that may occur in the immediate vicinity of Cincinnati in the intervening three days.

By taking the average of the stages about the 50-foot stage occurring at Parkersburg and the average of the subsequent corresponding stages at Cincinnati, some idea can be formed of what the stage at Cincinnati will be, within certain limits, whenever a 50-foot stage or thereabout occurrs at Parkersburg. This is roughly the method by which the tables of corresponding wave-crest water heights given here have been obtained for various places.

On a sheet of cross-section paper the average stages about a certain stage were plotted as abscissas. The later corresponding average stages at a place farther down-stream were plotted as ordinates. The stages were usually grouped according to the stage at the upper place, the means being taken for all between 15 to 20 feet, 20 to 25, 25 to 30, etc. Through the points obtained by the intersections of the abscissas and ordinates a curve was drawn. From this curve, for stages 1 foot apart at the upper station, the stages for the lower station were taken, which are given in the tables. From a comparison of the actual stages with the stages given by the table, a series of residuals was derived for each group of stages.

From the residuals the probable error given for some stages the number with sign $\pm$ plus or minus was obtained by taking it as 0.85 of the average of the residuals, regardless of the sign of residual.

Considering a residual as the error in a computed or predicted river stage for a place, the significance of the probable error is, that if the residuals, in a case where they are numerous, are all arranged in the order of their magnitude, the middle one is the probable error. In one-half of the cases the actual error will be greater than the probable error and in the other half less. The greatest error in a series of twenty predictions of stages is usually about three times the probable error.

For a river formed by numerous large tributaries the method of devising rules for river-stage prediction best adapted to the purpose was found to be by comparison of the rises at a place with the preceding rises in the tributaries. Long records are necessary in a case of this kind with rises sometimes in one tributary and sometimes in another, and with rises at times in two or more of the tributaries in order to disentangle the effects of the various tributaries in producing a rise in the main stream.

Stages predicted by the rules here given are only approximations to the stages that may be reasonably expected. Simplicity and easiness of application in any particular case have been considered in preparing the rules, as far as the complexity of the subject would allow.

The rules given here were used in predicting the high stages of the Ohio and Mississippi rivers in the years 1890 and 1891, and in most instances were found to give tolerably satisfactory results. They are, however, merely a first approximation. Improvements can be made as the records accumulate, and even with the records now available by introducing some slight variations in the method of deriving them.

Predictions of river stages or floods are never made on prospective rainfall.

No predictions of floods are ever made for streams without river gauges. A river rarely rises from low water to flood stage from a single rainstorm. Floods usually result from a great or even a moderate rainfall when a river is already high.

The distribution of rainfall over a drainage area in time and space is sometimes the determining cause of a high stage of water at a place lower down when there is an opportune coincidence of wave crests from tributaries.

Augusta, Ga., on the Savannah River is the only place for which as yet a definite rule is ventured for the prediction of river stages from rainfall observations alone.

A very great improvement in the rule for predicting stages at Pittsburg and St. Louis it is expected can be made from an analysis of the rainfall observations in the immediate drainage areas of the places.

The stage of a river is the vertical height of its surface in feet and tenths of a foot above low water. This is observed by means of a board graduated to feet and tenths fastened to a bridge pier, or laid along the river bank. The observation is made by noting the point on board to which the water surface reaches. The zero of a river gauge is put somewhere near the level of the lowest water that is apt to occur. A gauge, however, once set in place and a record of the stages for some time being kept it is not customary to change the level of the zero even if the stage of water does go below the zero. A stage below the zero of a gauge is given with a minus sign. When a gauge is first set up it is desirable to put the zero so low that no low water will ever go below it, thus avoiding the occurrence of minus stages which are inconvenient in use and apt to lead to errors.

When a gauge is renewed or repaired care is taken to get the zero back to the same level at which it was first. For this purpose, and to ascertain from time to time whether the zero of a gauge or any of its marks are settling or changing in level, a bench mark is established. A bench mark is some presumably constant surface, the top of some large stone in a bridge pier or some public building, such as a custom-house, post-office, or city hall. A copper bolt imbedded in the wall of a stone building is common device for a bench mark. The difference in level of the bench mark and the zero or some other mark on the gauge is ascertained by means of a leveling instrument.

The danger line or flood line for a place is some arbitrarily assumed stage, a rise above the plane of which will presumably be attended with material damage to property unless the precaution is taken to move goods.

The velocity of water in rivers varies from 2 to 4 miles an hour, depending on the stage, being swifter the higher the water. Water entering rivers after rain requires considerable time to reach places along the lower courses of the rivers. From the observed stages at upper points some approximate idea can be formed of the highest stages that will subsequently occur at the lower points and the time of occurrence.

The time of the crest wave in a freshet from Pittsburg to Wheeling is one day, from Pittsburg to Parkersburg two days, from Parkersburg to Cincinnati three days, from Cincinnati to Cairo six days, from Cairo to Vicksburg seven days, and from Vicksburg to New Orleans four days. The progressive character of flood waves permit of warning places of a coming high stage of water.

The rate of progress of a flood wave does not differ materially from the average velocity of the water throughout a cross section of the river. The fact that the river bed has to be filled by a rise of river exercises a slightly retarding influence on the time of a flood wave.

The stages of water at many of the places with river gauges are telegraphed daily to Washington City and are the basis for making river-stage predictions for points along the lower courses of various rivers.

The observed depths of rainfall at places reporting daily by telegraph to Washington City are used to some extent in estimating coming stages of water. These, however, are of very little importance for prediction purposes as compared with observations of river stages where there are two gauges on a river at a considerable distance apart, 80 to 100 miles or so.

Very little has been as yet developed regarding the relation between rainfall over various drainage areas and subsequent river stages, but it is believed that something of importance can be derived.

The nearer together two gauges are on a river the more accurate as a rule predictions of the stages of water can be made from the observed stages at the upper one. The closer together, however, the gauges are, the more quickly the stages succeed and the less the value of any predictions. To make the predicted stages and warnings of floods of value to the public by giving as timely notice as possible some sacrifice has to be made in the accuracy of the prediction, and therefore gauges are chosen for prediction purposes some considerable distance apart.

The length of time river-stage records have been kept is very various at different places; some places have a record for thirty years or more, while others have not had gauges for more than a year. A record of several years covering the entire range of water stages from the highest to the lowest, is essential in order to derive rules for the prediction of high-water stages for a place. The longer the record at two places for which wave-crests are dependent the more accurate the rules can be derived for obtaining high water.

There are 144 river stations of the Weather Bureau at which the stages of water are observed, in most cases at least once a day all the year round. The published records of river stages at the Weather Bureau stations, and the gauge records of the Mississippi River Commission and the Missouri River Commission have been used in deriving the rules given here for predicting stages at various places.

The titles of these publications are as follows:

"Regular Gauge Histories," including readings on Missouri river-gauges from 1872 to 1886, both inclusive; issued by the Missouri River Commission.

"Stages of the Mississippi River from Cairo to Carrollton, Preliminary to Stages of the Mississippi and its Tributaries," including readings from 1871 to 1886, both inclusive; issued by Mississippi River Commission.

"Stages of the Mississippi River above Cairo and of the Tributaries of the Mississippi River, except the Missouri River," including readings from 1871 to 1886, both inclusive; issued by Mississippi River Commission, 1889.

"Stages of the Mississsppi River and of its Principal Tributaries except the Missouri River for 1887 and 1888. Compiled at the Secretary's office, Mississippi River Commission, 1889."

"Stages of the Mississippi River and of its Principal Tributaries except the Missouri for 1889. Compiled at the Secretary's office, Mississippi River Commission, 1890."

"Missouri River Commission. Stages of the Missouri River from St. Charles, Mo., to Sioux City, Iowa. Compiled from Miscellaneous and Regular Gauge Records, 1886 to 1889, both inclusive." Mississippi River Commission print, 1890."

"Stages of the Ohio River and of its Principal Tributaries, 1858, to 1889, inclusive. Part I. Washington City, Signal Office, 1890."

"Stages of the Mississippi River and of its Principal Tributaries except the Ohio River, 1860 to 1889, both inclusive. Part II. Washington City, Weather Bureau Office, 1891."

"Stages of Water at Miscellaneous River Stations in California, Oregon, North Carolina, etc., 1875 to 1889, both inclusive. Part III. Washington City, Weather Bureau Office, 1891."

As a rule, better predictions for a place can be made the greater the part of the total drainage area above the upper gauge, the readings of which serve as the basis for predicting the stages for the place below it.

It is not possible to make very accurate predictions of stages for the lower places owing to the irregular distribution of rainfall over a drainage basin, and from the fact that considerable volumes of water are in some instances, added to a river by tributaries coming into the river between the gauges.

The predictions of river stages are of three classes.

(1) River-stage predictions from rainfall for a river with only one gauge, as Augusta on the Savannah, Mount Holly on the Catawba.

(2) River-stage predictions for a place from observed stages at a point above where there are no large tributaries coming into the river between, as Carthage and Nashville from Burnside, and Eddyville from Nashville on the Cumberland River.

(3) River stage predictions from gauge readings at upper points where dependent on the stages in tributaries as well as in the main river, as Cairo for instance, dependent on the stages at St. Louis, Vincennes, Cincinnati, Nashville and Chattanooga, and St. Louis, dependent on stages at Kansas City on the Missouri, Dubuque on the Mississippi, and Peoria on the Illinois.

The rules for prediction for various places here given have been derived by empirical and graphical processes. In some cases a number of methods were tried and the one found to be best is the one given.

The best method of prediction in the case of a river with tributaries was found to be the method of comparative corresponding rises.

The higher the river stage at a place the more effectual a rise of a given amount is in producing a rise at points below it. For a low stage at a lower point a rise at a point higher up will produce a greater rise than when the stage at the lower point is high. The quantities to be compared in rises have been taken as the products of the rises by the mean stages during the rises. This is arbitrarily assumed. Observations of river discharge are necessary to give the relation of rises accurately.

It is entirely out of the question to deal with river prediction as a problem in dynamics to be solved theoretically on physical principles because of the complexity of the conditions involved, the varying slope, cross section, hydraulic depth, tortuousness of channel, etc. Moreover, an accurate solution is not to be thought of on account of the varying quantities of water coming into the river between gauges in different freshets.

The most that can be expected, is that the stages predicted will be somewhere near what may be expected. This will be a zone of stage rather than any definite stage.

The predicted stages for any place are very rarely in error more than 3 feet.

Floods rarely occur as the result of a single rainstorm causing a river to rise from a low stage to the top of its banks in one day. Overflows are usually preceded by a slow steady rise extending over several days, and then a great rainfall carrying the water to the flood line. Occasionally, however, this does happen, as, for instance, at Tuscaloosa, Ala., when the Big Warrior rose in a single night 65 feet, on March 25, 1881.

No predictions of high waters for rivers without gauges can ever be justifiable without at least 2.5 inches of rainfall observed at three stations or more in the drainage basin of a river.

PITTSBURG, PA.

The danger line at Pittsburg is at the 22-feet stage.

The highest water observed was 35 feet, February 10, 1832.

The drainage area of the water passing Pittsburg is 19,460 square miles. The stages at six places above Pittsburg are used for estimating the rise of water at Pittsburg for one or two days in advance. These stations, with the drainage areas in square miles above them, are Oil City, 3,720; Brookville, 400; Johnstown, 628; Confluence, 1,380; Rowlesburg, 1,320, and Weston, 380.

The distances from Pittsburg to these places in miles and the differences in elevation of zeros, of gauges are as follows:

	Distance.	Elevation.
Pittsburg to—	*Miles.*	*Feet.*
Oil City	109	318
Brookville	88	476
Johnstown	85½	451
Confluence	72	627
Rowlesburg	110	678
Weston	145	127

Rises in the rivers at these places are followed by rises at Pittsburg one or two days after. By comparing the mean of the crest stages at the six places with the stages following after at Pittsburg the following comparative stages are obtained:

Mean of stages Oil City, Brookville, Johnstown, Rowlesburg, Weston, and Confluence.	Pittsburg crest one day after.	Mean of stages Oil City, Brookville, Johnstown, Rowlesburg, Weston, and Confluence.	Pittsburg crest one day after.	Mean of stages Oil City, Brookville, Johnstown, Rowlesburg, Weston, and Confluence.	Pittsburg crest one day after.
3.0	8.0	5.6	15.6	8.2	21.8
3.1	8.3	5.7	15.7	8.3	21.9
3.2	8.6	5.8	16.0	8.4	22.0
3.3	9.0	5.9	16.2	8.5	22.1
3.4	9.4	6.0	16.4	8.6	22.2
3.5	9.7	6.1	16.7	8.7	22.3
3.6	10.2	6.2	17.0	8.8	22.4 ±1.2
3.7	10.4	6.3	17.3	8.9	22.5
3.8	10.7	6.4	17.6	9.0	22.6
3.9	11.1	6.5	17.8	9.1	22.7
4.0	11.6	6.6	18.2	9.2	22.8
4.1	11.8	6.7	18.4	9.3	22.8
4.2	12.2	6.8	18.6	9.4	22.9
4.3	12.4	6.9	18.8	9.5	23.0
4.4	12.7	7.0	19.0	9.6	23.1
4.5	12.9	7.1	19.3	9.7	23.2
4.6	13.2	7.2	19.6	9.8	23.3
4.7	13.4	7.3	19.8	9.9	23.4
4.8	13.7	7.4	20.2	10.0	23.5
4.9	14.0 ±1.2	7.5	20.4	10.1	23.6
5.0	14.3	7.6	20.6	10.2	23.7
5.1	14.5	7.7	20.8	10.3	23.8
5.2	14.7	7.8	21.1	10.4	23.9
5.3	14.9	7.9	21.3	10.5	24.0
5.4	15.2	8.0	21.5	10.8	*31.3
5.5	15.4	8.1	21.7		

* February 18, 1891.

The rise at Pittsburg is greater than the mean rise at the six stations in the following ratios for different stages at Pittsburg:

FACTOR FOR PITTSBURG RISE IN TERMS OF THE MEAN RISE AT SIX STATIONS.

Pittsburg stage.	Pittsburg factor.
4	3.61
5	3.44
6	3.27
7	3.10
8	2.93
9	2.76
10	2.61
11	2.44
12	2.27
13	2.10
14	1.93
15	1.76

A comparison of the wave crests at Oil City and Confluence and those at Pittsburg show the following:

PITTSBURG CREST.

Oil City.	Confluence (feet).														
	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
Feet.	*Ft.*	*Ft.*	*Ft.*	*Ft.*	*Ft.*	*Ft.*	*Ft.*	*Ft.*	*Ft.*	*Ft.*	*Ft.*	*Ft.*	*Ft.*	*Ft.*	*Ft.*
3...	9	....	11	12	....	....	....	....	....	....	20	21	22	23	24
4...	10	10	11	12	....	....	....	....	....	....	21	21	....	....	....
5...	11	11	12	13	13	16	20	....	22	22	22	22	....	....	....
6..	11	11	12	13	14	16	20	....	22	22	22	22	....	....	....
7...	12	12	13	14	15	16	21	21	22	22	22	23	....	....	....
8...	13	13	13	14	15	17	21	21	22	23	23	23	....	....	....
9...	....	14	14	15	16	18	22	22	22	23	23	24	....	....	....
10...	....	14	14	15	16	19	22	23	23	23	23	24	....	....	....
11...	....	15	15	16	16	20	23	24	24	24	24	25	....	....	....
12...	....	16	16	16	18	21	24	25	25	25	25	25	....	....	....
13...	....	....	16	18	20	23	24	25	25	25	25	26	....	....	....
14...	....	....	18	18	20	23	24	25	25	25	25	26	....	....	....
15...	....	....	20	20	20	23	24	25	25	26	26	27	....	....	....
16...	....	....	....	....	....	....	25	26	26	27	27	27	....	....	....
17...	....	....	....	....	....	....	....	....	....	....	....	28	....	....	....
18...	....	....	....	....	....	....	....	....	....	....	....	28	....	....	....

The rise at Pittsburg as compared with the mean of the rises at Oil City and Confluence is on the average 2.3 times as great.

The following are the stages greater than 20 feet at Pittsburg and the stages at points above for which there are any observations.

GAUGE READINGS.

Date.	Pittsburg.	Oil City.	Brookville.	Confluence.	Rowlesburg.	Weston.	Johnstown.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
1874.							
Dec. 27				1.0			
Dec. 28	5.9			8.5			
Dec. 29	18.5			13.2			
Dec. 30	21.0						
Dec. 30	20.0						
Dec. 31		3.3					
1875.							
July 31				5.3			
Aug. 1	13.7			5.4			
Aug. 2	17.2			14.8			
Aug. 2				12.3			
Aug. 3	21.0						
1877.							
Jan. 14				3.1			
Jan. 15	11.8	3.6		3.7			
Jan. 16	18.3	3.7		11.1			
Jan. 16				9.9			
Jan. 17	22.1	4.2					
1878.							
Dec. 8				1.5			
Dec. 9	7.0	3.7		2.2			
Dec. 10	11.8	8.1		7.8			
Dec. 11	24.5	11.8					
Dec. 11	23.4	11.7					
1881.							
Feb. 9	4.5	2.3					
Feb. 10	20.6	4.5		7.2			
Feb. 11	23.2	8.0		9.6			
Feb. 12				11.6			
June 7				1.8			
June 8	8.8	2.0		3.5			
June 9	16.0	4.5		8.6			
June 10	27.1						
June 10	25.1	12.2					
1882.							
Jan. 24				2.2			
Jan. 25		10.0		2.8			
Jan. 26	8.3	3.2		8.3			
Jan. 27	19.4	10.4					
Jan. 28	21.7						
Jan. 28	21.5						
Feb. 19				7.2			
Feb. 20	15.0	4.0		8.4			
Feb. 21	19.6	6.7		10.5			
Feb. 22	21.1	8.2					
1883.							
Feb. 2		2.0					
Feb. 3	5.5	2.7		2.8			
Feb. 4	15.2	18.0		2.8			
Feb. 5	24.8	17.3		5.6			
Feb. 6	20.7	17.2					
Feb. 7		7.0		13.8			
Feb. 8	27.6						
Feb. 13				4.5			
Feb. 14	12.8	4.0		4.2			
Feb. 15	19.2	5.0		5.7			
Feb. 16	20.7	5.0					
Feb. 18		8.2					

GAUGE READINGS—Continued.

Date.	Pittsburg.	Oil City.	Brookville.	Confluence.	Rowlesburg.	Weston.	Johnstown.
1884.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Feb. 3	....	....	....	3.4	....	....	....
Feb. 4	11.1	....	....	3.2	....	....	....
Feb. 5	15.8	....	....	9.9	....	....	....
Feb. 6	33.3	....	....	....	....	....	....
Feb. 6	31.9	....	....	....	....	....	....
1885.							
Jan. 15	9.0	....	1.1	4.2	3.2	....	1.2
Jan. 16	11.8	....	1.2	8.1	6.5	....	4.5
Jan. 17	23.0	....	....	....	....	....	....
Jan. 17	22.0	....	5.0	9.5	9.0	....	7.0
1886.							
Jan. 3	....	2.8	—0.8	3.2	....	0.9	1.3
Jan. 4	8.0	3.6	2.0	5.4	3.4	1.5	4.3
Jan. 5	17.6	10.0	6.0	8.6	4.6	4.0	8.5
Jan. 6	20.2	....	....	....	5.0	....	....
Mar. 30	11 1	....	0.6	5.3	7.0	2.5	3.0
Mar. 31	11 8	3.8	1.6	6.4	9.0	5.0	3.4
Apr. 1	20.0	8.3	4.6	8.7	12.0	8.0	6.8
Apr. 2	....	....	....	....	6.0	....	....
Apr. 3	....	....	....	....	4.4	....	....
Apr. 4	....	....	2.0	4.3	6.0	3.1	....
Apr. 5	13.4	5.4	2.0	5.1	....	2.7	2.1
Apr. 6	20.2	5.5	4.8	5.3	....	17.0	2.8
Apr. 7	22.6	....	....	....	....	....	....
Apr. 7	22.2	8.7	....	....	....	....	3.6
1887.							
Feb. 2	9.9	....		2.9	....	1.5	....
Feb. 3	10.0	4.3	....	3.9	6.0	11.0	....
Feb. 3	....	....	....	....	12.6	....	1.2
Feb. 4	20.0	4.8	....	9.3	10.0	....	3.8
Feb. 8	....	....	7.0	....	....	....	....
Feb. 9	....	13.8	....	....	....	....	....
Feb. 10	....	....	....	4.1	....	1.0	3.4
Feb. 11	16.0	11.4	....	4.7	5.2	4.0	4.6
Feb. 12	21.9	15.0	....	5.4	5.5	....	4.6
Feb. 22	....	....	3.0	....	....	....	....
Feb. 23	....	....	2.5	....	....	....	....
Feb. 24	....	....	3.0	....	....	....	....
Feb. 25	10.5	4.2	....	2.9	4.6	3.0	2.0
Feb. 26	11.0	4.1	....	2.8	4.6	2.0	1.7
Feb. 26	....	....	....	....	....	12.0	....
Feb. 27	20.3	4.2	....	5.1	8.0	11.0	2.0
1888.							
Jan. 5	....	7.0	....	3.3	....	....	....
Jan. 6	5.3	7.2	....	3.9	4.1	0.5	2.6
Jan. 7	11.5	....	....	9.5	8.0	0.8	3.6
Jan. 8	21.3	....	4.0	....	8.3	6.6	9.0
Aug. 17	....	0.2	....	....	....	....	....
Aug. 18	....	1.0	....	....	....	....	....
Aug. 19	....	1.0	....	....	....	....	....
Aug. 20	....	....	....	....	....	1.0	....
Aug. 21	5.3	....	....	....	....	2.0	0.5
Aug. 22	25.8	....	....	11.9	....	....	....
Aug. 22	23.0	....	....	....	....	....	18.0
1889.							
May 30	....	....	0.0	....	4.6	0.5	....
May 31	4.3	1.7	3.4	16.7	6.1	5.3	20.0
May 31	....	....	....	9.6	....	....	....
June 1	19.6	2.0	14.0	12.0	6.0	....	....
June 1	24.0	....	....	6.1	....	....	....
June 2	21.8	9.6	....	....	....	....	....
June 3	....	10.0	....	....	....	....	....

GAUGE READINGS—Continued.

Date.	Pitts-burg.	Oil City.	Brook-ville.	Con-fluence.	Rowles-burg.	Weston.	Johns-town.
1890.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Mar. 20	......	......	......	......	6.0	......	......
Mar. 21	......	......	......	......	......	2.0	9.5
Mar. 21	......	2.9	0.7	5.6	6.4	......	5.3
Mar. 22	15.5	4.4	2.2	9.0	9.7	10.0	9.5
Mar. 22	......	......	......	......	......	18.4	11.0
Mar. 23	22.3	5.9	2.4	10.9	......	13.6	10.5
Mar. 24	22.5	......	......	......	......	......	......
May 22	......	9.5	......	2.9	......	1.7	3.9
May 23	13.6	9.0	......	2.6	5.0	1.4	4.1
May 24	16.5	13.4	6.5	7.5	5.0	1.2	6.5
May 24	22.0	......	......	......	......	......	......
May 25	19.5	......	4.9	......	6.0	......	5.3
May 26	......	......	7.0	......	......	......	8.9
1891.							
Feb. 15	......	......	......	4.3	......	......	......
Feb. 16	......	......	......	......	......	......	7.3
Feb. 16	9.3	3.5	2.5	6.9	5.0	3.5	16.1
Feb. 17	24.2	16.2	10.0	12.3	5.7	3.0	17.1
Feb. 18	31.3	15.9	9.0	10.1	6.0	3.0	10.8

Where the rises at Pittsburg have extended over two, three, four, and five days, the mean rises on successive days to the crests, have been as follows:

	Feet.	Feet.	Feet.
6th to 5th	......	......	1.4
5th to 4th	......	......	2.6
4th to 3d	......	......	2.2
3d to 2d	......	1.4	0.6
2d to 1st	4.4	5.8	2.5
1st to crest	6.0	4.5	2.8

WHEELING, W. VA.

The danger line at Wheeling is at the 36-feet stage.
The highest water observed was 54 feet on February 7, 1884.
The stages of water are the result of the stages at Pittsburg one day before.
The distance from Wheeling to Pittsburg is 71 miles. The difference in level of the zeros of gauges is 85.4 feet.
The following are the comparative stages at the places for high-water crests:

COMPARISON OF CRESTS AT PITTSBURG AND WHEELING.

Pittsburg.	Wheeling one day after.		Pittsburg.	Wheeling one day after.	
13	18.7		23	32.5	
14	19.8	±1.3	24	34.2	
15	21.3		25	35.6	±1.4
16	22.4		26	37.0	
17	23.9		27	39.2	
18	25.4		28	41.0	
19	27.0		29	42.5	
20	28.4		30	44.5	
21	29.8	±1.4	31	47.0	
22	31.4		32	49.0	

The rise at Wheeling in two days is 1.3 times as great as the rise at Pittsburg in the same interval.

The following are some of the important stages at Wheeling with those at Pittsburg preceding them:

COMPARISON OF WATER CRESTS.

Pittsburg.		Wheeling.	
Date.	Feet.	Date.	Feet.
1883.			
Feb. 7	20.7	....	34.5
Feb. 8	26.8	Feb. 8	35.5
Feb. 14	12.8	Feb. 15	28.2
Feb. 15	19.2	Feb. 16	32.6
Feb. 16	20.7	Feb. 17	33.2
1884.			
Feb. 4	11.1	Feb. 5	23.0
Feb. 5	15.8	Feb. 6	38.0
Feb. 6	31.9	Feb. 7	46.5
1885.			
Jan. 15	9.0	Jan. 16	16.5
Jan. 16	11.8	Jan. 17	26.0
Jan. 17	22.0	Jan. 18	32.8
1886.			
Apr. 5	13.4	Apr. 5	18.0
Apr. 6	20.2	Apr. 6	22.0
Apr. 7	22.2	Apr. 7	31.3
1887.			
Feb. 11	16.0	Feb. 11	29.4
....	....	Feb. 12	29.8
Feb. 12	21.9	Feb. 13	33.8
1889.			
May 31	4.3	May 31	7.4
June 1	19.6	June 1	7.9
June 2	21.8	June 2	28.9
1890.			
Mar. 22	15.5	Mar. 22	17.0
Mar. 23	22.3	Mar. 23	26.9
Mar. 24	22.5	Mar. 24	32.5
1891.			
Feb. 16	9.3	Feb. 17	25.0
Feb. 17	24.2	Feb. 18	40.4
Feb. 18	31.3	Feb. 19	44.6

TWO-DAY RISES.

Pittsburg.	Wheeling.	Pittsburg.	Wheeling.
7.9	5.0	12.9	20.6
9.6	11.0	2.0	9.8
20.8	31.0	6.5	7.6
6.8	8.0	22.0	19.6
4.3	4.7	13.5	14.3
13.0	16.3	7.9	8.3
12.2	16.8	17.5	21.5
11.9	11.0	5.9	13.5
8.8	13.3	8.3	13.2
1.2	3.0	7.7	10.1
6.3	8.3	9.3	9.3
10.0	15.7	7.0	15.5
5.9	4.4	6.4	6.7
9.3	12.3	7.1	10.7
9.5	9.0	5.9	2.7
16.0	18.6	9.2	11.7
4.5	5.3		
7.3	10.2		

MARIETTA, OHIO, AND PARKERSBURG, W. VA.

Marietta is 12½ miles above Parkersburg. The river stages at the two places are nearly identical.

The danger line at Marietta is at the 25-feet stage.

The highest water at Marietta was 52 feet, February 9, 1884; at Parkersburg it was 55 feet.

The distance from Marietta to Pittsburg is 151 miles. The difference in level of the zeros of the gauges is 128 feet.

The water passing Parkersburg drains from 36,620 square miles.

The corresponding crest-wave stages at Pittsburg and Parkersburg are shown in the following table.

The interval in time is two days.

CORRESPONDING STAGES AT PITTSBURG AND MARIETTA OR PARKERSBURG.

Pittsburg.	Parkersburg or Marietta 2 days after.	Pittsburg.	Parkersburg or Marietta 2 days after.
8	15.2	21	30.3
9	16.0	22	31.7 ±3.0
10	16.7	23	33.5
11	17.4	24	35.5
12	18.3	25	37.5 ±2.2
13	19.0	26	39.2
14	20.5	27	41.0
15	21.6	28	42.5
16	23.0	29	44.0
17	24.4	30	45.7
18	25.5	31	47.3
19	27.2 ±1.5	32	48.7
20	28.7		

Two days between crests.
The average daily rises to crests are as follows:

	Feet.	Feet.
6th to 5th	......	2.0
5th to 4th	......	3.0
4th to 3d	3.3	4.5
3d to 2d	3.7	3.4
2d to 1st	4.0	4.0
1st to crest	2.7	2.7

Besides the water passing Pittsburg there also goes by Marietta and Parkersburg water from the Muskingum River, which drains about 12,000 square miles. On this river there is a gauge at Zanesville, 65 miles above the mouth.

The change from low to high water is 1.44 greater at Parkersburg than Pittsburg in cases where the rise at Parkersburg goes above the 25 feet stage.

The following are some of the important rises at Marietta or Parkersburg and those preceding at Pittsburg:

CORRESPONDING RISES FROM LOW TO HIGHEST WATERS AT PITTSBURG, PA., AND MARIETTA, OHIO.

Pittsburg, Pa.			Marietta, Ohio.		
Date.	Gauge readings.	Rise.	Date.	Gauge readings.	Rise.
1878.	*Feet.*	*Feet.*	1878.	*Feet.*	*Feet.*
Nov. 25	11.3	7.4	Nov. 26	17.8	8.4
Nov. 28	18.7		Nov. 29	26.2	
Dec. 9	7.0	16.4	Dec. 9	12.2	19.9
Dec. 11	23.4		Dec. 13	32.1	
1879.			1879.		
Jan. 12	2.8	10.0	Jan. 15	7.2	18.0
Jan. 19	12.8		Jan. 21	25.2	
Jan. 27	8.9	10.9	Jan. 27	17.5	10.7
Jan. 29	19.8		Jan. 30	28.2	
Mar. 6	10.5	9.4	Mar. 4	15.0	14.7
Mar. 12	19.9		Mar. 13	29.7	
Dec. 29	7.1	8.9	Dec. 31	11.3	17.0
Jan. 3	16.0		Jan. 8	28.3	
1880.			1880.		
Feb. 11	3.8	17.8	Feb. 11	6.5	25.0
Feb. 14	21.6		Feb. 16	31.5	
1881.			1881.		
Feb. 8	3.2	20.0	Feb. 8	6.0	33.5
Feb. 11	23.2		Feb. 13	39.5	
Mar. 16	8.0	6.5	Mar. 18	13.9	7.1
Mar. 21	14.5		Mar. 22	21.0	
Apr. 7	4.3	14.2	Apr. 7	7.5	20.0
Apr. 14	18.5		Apr. 16	27.5	
June 2	2.0	23.1	June 3	4.7	29.9
June 10	25.1		June 12	34.6	
1882.			1882.		
Jan. 25	6.4	15.1	Jan. 23	15.5	17.7
Jan. 28	21.5		Jan. 29	33.2	
Feb. 17	10.9	10.2	Feb. 13	19.5	15.6
Feb. 22	21.1		Feb. 23	35.1	
1883.			1883.		
Feb. 3	5.4	21.3	Feb. 3	11.0	32.7
Feb. 8	26.7		Feb. 9	43.7	
Feb. 14	12.7	7.9	Feb. 14	28.0	9.7
Feb. 16	20.6		Feb. 17	37.7	

CORRESPONDING RISES FROM LOW TO HIGHEST WATERS AT PITTSBURG, PA., AND MARIETTA, OHIO—Continued.

Pittsburg, Pa.			Marietta, Ohio.		
Date.	Gauge readings.	Rise.	Date.	Gauge readings.	Rise.
1884.	*Feet.*	*Feet.*	1884.	*Feet.*	*Feet.*
Feb. 4	11.1	20.8	Jan. 27	6.5	45.5
Feb. 6	31.9		Feb. 1	21.5	
			Feb. 9	52.0	
Mar. 7	3.7	15.1	Mar. 6	7.2	25.6
Mar. 13	18.8		Mar. 15	32.8	
1886.			1886.		
Apr. 4	12.2	9.9	Apr. 5	23.0	9.1
Apr. 7	22.1		Apr. 9	32.1	
1887.			1887.		
Feb. 3	10.0	10.0	Feb. 2	18.3	9.9
Feb. 4	20.0		Feb. 6	28.2	
Feb. 7	11.0	10.9	Feb. 8	21.0	12.0
Feb. 12	21.9		Feb. 14	33.0	
Feb. 24	9.0	11.2	Feb. 25	17.8	13.8
Feb. 27	20.2		Feb. 28	31.6	
1888.			1888.		
Jan. 6	5.2	16.0	Jan. 6	*9.0	18.9
Jan. 8	21.2		Jan. 10	*27.9	
Aug. 21	5.3	17.7	Aug. 16	3.1	24.9
Aug. 22	23.0		Aug. 24	28.0	

Pittsburg.			Parkersburg.		
1890.			1890.		
Jan. 6	6.5	10.1	Jan. 6	9.9	17.0
Jan. 9	16.6		Jan. 10	26.9	
Jan. 15	9.3	8.3	Jan. 14	15.9	14.0
Jan. 17	17.6		Jan. 18	29.9	
Feb. 3	7.0	7.7	Feb. 5	13.7	11.9
Feb. 5	14.7		Feb. 9	25.6	
Feb. 14	6.7	9.3	Feb. 14	13.7	12.1
Feb. 16	16.0		Feb. 18	25.8	
Mar. 19	8.7	13.8	Mar. 21	16.9	18.1
Mar. 24	22.5		Mar. 25	35.0	
Apr. 8	11.4	7.2	Apr. 9	18.8	7.8
Apr. 10	18.6		Apr. 12	26.6	
May 23	13.6	5.9	May 20	14.3	15.2
May 25	19.5		May 26	29.5	
Sept. 9	5.9	9.3	Sept. 11	9.9	17.3
Sept. 14	15.2		Sept. 15	27.2	
1891.			1891.		
Feb. 16	9.3	22.0	Feb. 16	16.0	28.6
Feb. 17	24.2		Feb. 21	44.6	
Feb. 18	31.3		Feb. 20	†44.3	

* Zanesville, 6th, 7.6; 8th, 15.9.

† Marietta, 43.8.

The stages at Parkersburg are influenced by the Little Kanawha River, at the mouth of which it is situated. There is no gauge on this river.

POINT PLEASANT, W. VA.

The danger line at Point Pleasant is at the 36-feet stage.
The distance to Parkersburg is 80 miles.
Point Pleasant is at the mouth of the Great Kanawha River.

The corresponding wave-crest stages at Parkersburg and Point Pleasant one day later are as follows:

Marietta or Parkersburg.	Point Pleasant, one day after.	Marietta or Parkersburg.	Point Pleasant, one day after.
5	5.0 ±0.8	26	31.4
		27	32.6
6	6.2	28	34.2
7	7.3	29	35.8
8	8.6	30	37.4
9	9.9		
10	11.2 ±0.5	31	39.0
		32	40.5
11	12.4	33	42.0
12	13.7	34	42.7
13	15.1	35	43.4
14	16.4		
15	17.9 ±1.8	36	44.0
		37	44.7
16	19.3	38	45.4
17	20.6	39	46.1
18	21.9	40	46.8
19	23.0		
20	24.1 ±1.5	41	47.5
		42	48.2
21	25.5	43	49.0
22	26.8	44	49.5
23	27.9	45	50.0
24	29.0		
25	30.2 ±1.5		

The stages of water are dependent on water from the Great Kanawha River. There are gauges above at Charleston and Hinton.

GALLIPOLIS.

(Observations no longer taken.)

Gallipolis is directly opposite Point Pleasant.
The danger line at Gallipolis is at the 40 feet stage.
The corresponding wave-crest stages at Parkersburg and at Gallipolis one day later, are as follows:

Marietta.	Gallipolis, one day after.
12	17.0 ±1.6
13	18.2
14	19.3
15	20.5
16	21.6 ±1.3
17	22.7
18	23.7
19	24.8
20	26.0 ±2.1
21	27.3
22	28.9
23	29.9
24	30.4
25	30.9 ±2.3?
26	31.4
27	32.0
28	32.4

CHARLESTON, W. VA.

The danger line at Charleston, W. Va., is at 30 feet.
The highest water observed was 46.9 feet, September, 1861.
There is a gauge at Hinton above Charleston on the Kanawha, but the observations are not yet numerous enough to obtain trustworthy crests.
The rises at Charleston are ordinarily three times as great as those at Hinton.

CATLETTSBURG, KY.

Catlettsburg is at the mouth of the Big Sandy River.
The danger line is at 50 feet.
The stages of water are mainly the result of the stages at Parkersburg, but are also the result of stages at Charleston, W. Va., and Louisa, on the Big Sandy, 15 miles above.
The distance from Catlettsburg to Point Pleasant is 51 miles.
The corresponding crest-wave stages at Parkersburg and Catlettsburg two days after are as follows:

Parkersburg or Marietta.	Catlettsburg, two days after.	Parkersburg or Marietta.	Catlettsburg, two days after.
4	4.5 ±0.4	25	34.2 ±3.1?
5	6.5 ±0.2	26	35.4
6	8.6	27	36.6
7	10.3	28	37.7
8	12.1	29	38.8
9	13.5	30	39.9
10	15.4 ±1.8	31	41.0
11	17.0	32	42.1
12	18.8	33	43.2
13	20.7	34	44.3
14	21.7	35	45.4
15	23.0 ±2.0	36	46.5
16	24.1	37	47.6
17	25.3	38	48.7
18	26.4	39	49.8
19	27.5	40	50.9
20	28.6 ±2.1	41	52.0
21	29.8	42	53.1
22	30.9	43	54.2
23	32.0	44	55.3
24	33.0	45	56.1

PORTSMOUTH, OHIO.

The danger line at Portsmouth is at the 50-feet stage.
The distance from Portsmouth to Catlettsburg is 39 miles.
The distance to Marietta is 182½ miles. The difference in level of the zeros of gauges at Marietta and Portsmouth is 96.4 feet.
Portsmouth is at the mouth of the Scioto River. The stages of water are influenced mainly by those at Parkersburg, but water is also added below Parkersburg by the Kanawha, with gauge at Charleston, W. Va., by the Big Sandy, with gauge at Louisa, and by the Scioto, with gauge at Circleville.

The corresponding wave-crest river stages at Parkersburg and Portsmouth two days later are given below:

Parkersburg.	Portsmouth, two days after.		Parkersburg.	Portsmouth, two days after.	
7	11.2		22	31.3	
8	12.9		23	32.3	
9	14.3	±1.8	24	33.2	
10	15.7	±1.4	25	34.3	±2.7
11	17.1		26	35.3	
12	18.9		27	36.4	
13	20.5		28	38.3	
14	21.9		29	41.1	
15	23.3	±1.6	30	43.5	
16	24.6		31	45.9	
17	26.1		32	48.2	
18	27.4		33	50.9	
19	28.4		34	53.0	
20	29.4	±1.7	35	55.5	
21	30.3				

CINCINNATI RIVER STAGE.

The water going by Cincinnati, on the Ohio River, drains from an area of 78,360 square miles; that going by Parkersburg, W. Va., on the Ohio River, drains from 36,620 square miles; that going by Charleston, W. Va., on the Great Kanawha River, drains 12,640 square miles; that going by Louisia, Ky., on the Big Sandy River, drains from 3,800 square miles, and that going by Circleville, Ohio, on the Scioto River, drains from 4,400 square miles.

The Upper Ohio River above Parkersburg, the rivers of West Virginia and western Kentucky, are the important areas in flood production in the Ohio River. The land is relatively impermeable to water and the slopes are great, so that a very large part of a rainfall goes directly into the rivers. The north side of the Ohio River below Parkersburg is not significant in flood production. The slopes of the ground are light and the soil permeable. The rainfall sinks into the ground and is fed out slowly to the rivers through numerous springs. The distance from Cincinnati to Parkersburg, W. Va., by the river channel is 286 miles; to Charleston, W. Va., 235 miles; to Louisa, Ky., 178 miles; and to Circleville, Ohio, 158 miles.

These distances from Cincinnati are relatively as follows: To Parkersburg, W. Va., 1; to Charleston, W. Va., 0.93; to Louisa, Ky., 0.63, and to Circleville, Ohio, 0.66.

The elevation of zero of gauge at Cincinnati above mean ocean level is 425.02 feet; at Marietta, 569.045 feet; and at Charleston, W. Va., 554.4 feet.

In 104 cases of principal river rises at Cincinnati since May 9, 1873, the wave crest at Cincinnati occurred with respect to the wave crest at Parkersburg, W. Va., or Marietta, Ohio, as follows:

Cincinnati wave crest in 1 case, six days; 1 case, five days; 6 cases, four days; 39 cases, three days; 25 cases, two days; 18 cases, 1 day, after Parkersburg. Ten cases same day as Parkersburg; 2 cases one day, 1 case two days, 1 case three days before Parkersburg.

The flood of 1832, 63 feet, was four days after Marietta crest. (Ellet.)

The river stages at Parkersburg, W. Va., and Marietta, Ohio, are used interchangably. Marietta is 12½ miles above Parkersburg. Observations at Parkersburg were not begun until 1888.

Comparisons of the Marietta and Parkersburg gauge readings of the same days show close agreement. The means of the gauge readings for a number of months are shown below.

Months.	Mean of— Parkersburg gauge.	Mean of— Marietta gauge.
1888.		
July	8.7	8.5
August	7.6	7.5
September	7.1	6.9
October	9.8	....
November	12.8	12.9
December	9.0	9.4
1889.		
January	12.1	11.9
May	8.1	7.9

From this it may be judged that any relation that exists between Marietta and Cincinnati gauges also exists between the Cincinnati and Parkersburg gauges.

The Marietta gauge readings do not follow the Cincinnati gauge readings very closely, as might indeed be inferred from the fact that the Marietta drainage basin does not include more than two-fifths of the whole of the Cincinnati drainage basin.

There is a daily record of the river stage at Cincinnati since June 1, 1858; at Marietta, Ohio, since July 1, 1877; and at Pittsburg, Pa., since 1865.

There are rainfall records for Cincinnati and Pittsburg since 1870; for Columbus since July, 1878; and Marietta since July, 1877. There is a great mass of other rainfall records at various places in the catchment basin of the Ohio River above Cincinnati.

A comparison of the highest river stages at Pittsburg with corresponding subsequent high stages at Cincinnati shows that the Pittsburg gauge readings can not be of much use in forecasting the height of water at Cincinnati. The record of rises from January, 1881, to June, 1889, that seem to have a relation to each other, show that the rise at Cincinnati follows that at Pittsburg from four to six days. The differences between the low waters and next succeeding high waters at Cincinnati are generally greater than the corresponding differences at Pittsburg by amounts varying from 8 to 40 feet. In fifty-three cases there are only three exceptions to this rule. February 8 to 11, 1881, the rise at Pittsburg was 20 feet; at Cincinnati, February 11 to 16 ,it was 17.7 feet; December 22 to 26, 1881, the rise at Pittsburg was 11.6 feet; at Cincinnati, December 26 to January 1, it was only 6.2; August 2 to 4, 1885, the rise at Pittsburg was 7.2 feet; while at Cincinnati, August 5 to 10, it was 6 feet.

The water that passes Pittsburg drains from an area of 19,440 square miles. What passes Cincinnati drains from an area of 78,360 square miles, 59,000 more than Pittsburg. It is not surprising, therefore, that the gauges should show so little in common. As any particular rainfall is probably only seldom confined strictly to the limits of the Pittsburg catchment basin, the river rise at Pittsburg can be considered as an indication to some extent of rainfall taking place in the territory adjoining it. If there is reason to believe that of any particular rainfall no rain is falling in the basins of the Ohio outside of the Pittsburg basin it may be considered that the attendant rise at Cincinnati will be about 8 feet more than the corresponding rise at Pittsburg. If the rainfall is general throughout the Cincinnati basin the rise at Cincinnati may be 40 feet greater than the rise at Pittsburg.

On the whole, the Pittsburg river gauge-readings are not of much service in indicating coming stages of water at Cincinnati.

It has not been found possible to make any very definite use of the observations of the depth of rainfall in forecasting the rise of the river at Cincinnati.

If the rainfall stations were numerous, a hundred or more well distributed throughout the area, it would undoubtedly be possible to make some use of them. The time it would require, however, to collate a large mass of observations would forbid its practical use.

As things stand at present, with the few observations of rainfall that are received by telegraph daily from points in the Cincinnati drainage basin—Cincinnati, Columbus, Parkersburg, and Pittsburg—only excessive rainfalls, those amounting to more than 1 inch, can be of any use as a definite indication that a rise is going to take place In the case of a number of rainfalls reported the same day from various places the maximum rainfall at any place in the basin is a better indication of what the river rise is going to be than the mean of the rainfalls. This would not of course be the case if the rainfall stations were numerous. The mean would then be better. The fact that the maximum rainfall gives a better indication where there are only a few stations sending rainfall observations, shows that there are probably very much heavier rainfalls occuring at places from which no observations are received than at any of the stations where the observations are made.

The monthly means of the gauge readings at Cincinnati are higher than the corresponding means at Marietta. The difference is greater as the mean height of the Marietta gauge reading increases. The means of the months for the years 1885, 1886, 1887, and 1888 are given below for the two stations.

MONTHLY MEAN GAUGE READINGS.

Months.	Marietta.	Cincinnati.	Cincinnati minus Marietta.
1885.			
January	14.1	25.6	11.5
February	9.4	15.9	6.5
March	8.2	17.1	8.9
April	6.3	26.5	20.2
May	7.7	15.0	7.3
June	8.0	14.7	6.7
July	4.3	6.8	2.5
August	8.5	12.5	4.0
September	5.4	11.0	5.6
October	5.8	8.5	2.7
November	8.3	15.5	7.2
December	10.3	18.1	7.8
1886.			
January	13.0	24.6	11.6
February	13.1	25.9	12.8
March	10.9	20.3	9.4
April	17.8	37.4	19.6
May	8.5	21.9	13.4
June	5.9	15.4	9.5
July	4.4	13.8	9.4
August	4.6	10.0	5.4
September	3.1	5.4	2.3
October	3.2	5.2	2.0
November	8.6	12.2	3.6
December	10.0	19.4	9.4
1887.			
January	10.6	20.4	9.8
February	25.0	48.4	23.4
March	13.2	29.4	16.2
April	9.6	24.0	14.4
May	9.3	20.6	11.3
June	7.6	14.8	7.2
July	3.2	5.7	2.5
August	3.1	4.9	1.8
September	2.4	3.3	0.9
October	2.4	3.3	0.9
November	3.0	3.6	0.6
December	4.2	6.1	1.9
1888.			
January	11 6	20.2	8.6
February	10.7	20.1	9.4
March	....	23.0	....
April	11.7	23.8	12.1
May	6.9	13.8	6.9
June	4.8	10.4	5.6
July	8.5	14.6	6.1
August	7 5	12.0	4.6
September	6.9	16.4	9.5
October	....	17.9	....
November	12.9	27.4	14.5
December	9.4	16.2	6.8

For a mean monthly stage of 8.5 feet at Marietta the corresponding mean monthly stage at Cincinnati may be from 3.5 to 13.5 feet higher.

Through points platted on a sheet of paper, with the mean readings of the Marietta gauge as abcissas and the excess of the Cincinnati mean gauge readings over those at Marietta as ordinates, a smooth curve was drawn to represent the average of the differences of the two gauges. From this curve the following ordinates were taken, which may be considered as the average differences between the Marietta and Cincinnati gauge readings for different heights of the water on the Marietta gauge.

MEAN MONTHLY GAUGE READING.

Marietta.	Cincinnati higher than Marietta.	Marietta.	Cincinnat higher than Marietta.
3	1.0	15	16.5
4	2.5	16	17.5
5	4.2	17	18.2
6	5.6	18	19.4
7	7.0	19	20.0
8	8.7	20	20.8
9	9.7	21	21.6
10	10.7	22	22.3
11	12.0	23	22.7
12	13.0	24	23.1
13	14.2	25	23.4
14	15.2		

The corresponding curves of water level for Cincinnati and Marietta show that there is some connection between the rises and falls of the river at the two places. A rise in the curve at Marietta is usually followed by a rise in the Cincinnati curve. By far the greater number of crests of the curve at Cincinnati are from two to three days later than the corresponding crests at Marietta. The time for the crest of a wave of high water to travel from Marietta to Cincinnati is on the average two days and a half.

The rises that occur are of two kinds, depending on the extent of the rainfall and location of the place of greatest depth of rainfall. The river begins to rise at both places simultaneously, or the rise sets in at Cincinnati two or three days later than at Marietta. The rises are various in character. The greater number of them take place in from three to nine or ten days. The following table shows the daily changes during the rises.

TWENTY-FOUR HOUR CHANGES IN FEET IN OHIO RIVER DURING PRINCIPAL RISES AT MARIETTA AND CINCINNATI.

Feb. 9, 1878 (8.7) +2.8 +3.0 +2.0
Feb. 7, 1878 (18.2) +3.2 +1.4 +1.5 −0.6 +2.2 +1.8 +0.5

Apr. 24, 1878 (5.8) +2.1 +1.8 +3.1 +0.7 +0.0 +1.6 +1.6 +0.5
Apr. 27, 1878 (12.2) +3.3 +5.0 +2.7 +2.6 +3.3 +1.6

Mar. 10, 1878 (11.0) +0.2 +0.3 +4.0 +0.4 +0.5 +1.1
Mar. 11, 1878 (22.7) +1.8 +5.7 −0.3 +1.3 +1.9 +0.3

Jan. 10, 1878 (4.5) +4.7 −1.2 +6.2 +2.2 +0.5 +1.0
Jan. 12, 1878 (8.6) +7.2 +9.6 +1.3 +0.9 +0.9 +0.2

Dec. 22, 1879 (6.8) +0.2 +5.0 +8.0 +0.0 +1.2
Dec. 22, 1879 (17.0) +1.3 +3.7 +10.4 +6.1 +4.2

Sept. 12, 1878 (3.5) +13.2 +2.2 +0.6 +1.5
Sept. 13, 1878 (5.2) +0.2 +22.2 +7.7 +0.6

Nov. 23, 1877 (5.8) +1.8 +6.0 +6.7 +0.2
Nov. 26, 1877 (8.9) +13.6 +7.6 +1.5

Feb. 21, 1878 (10.8) +2.6 +2.8 +3.2 +4.2
Feb. 21, 1878 (19.9) +2.5 +0.0 −0.2 +3.5 +3.9 +2.1 +0.2

July 8, 1888 (5.3) +1.9 +11.0 −0.7 +4.0 +2.5
July 9, 1888 (8.8) +1.3 +3.4 +7.5 +7.7 +1.8 +1.0

Feb. 7, 1882 (9.8) +2.5 +2.3 +4.8 +2.1
Feb. 7, 1882 (26.8) +2.0 +1.0 +6.2 +2.9 +2.5 +4.2 +1.5

Jan. 6, 1882 (9.8) +2.5 +1.6 +1.8 +2.3 +3.5 −0.8 +1.8 +3.8
Jan. 6, 1882 (26.7) +2.0 +6.7 +2.0 +0.2 +3.2 +1.3 +4.6 +1.5 +0.2 −0.1

Dec. 22, 1881 (10.5) +4.0 +2.0 +5.1 +0.1 +1.6 −1.0 +2.2 +1.8
Dec. 26, 1881 (34.8) +1.2 +1.7 +1.7 +0.8 +0.7 +0.2

Apr. 7, 1881 (7.5) +0.3 +0.5 +2.0 +4.1 +2.0 +3.5 +4.0 +2.5 +1.0
Apr. 6, 1881 (20.9) +0.2 +3.6 +4.5 +4.1 +2.2 +0.4 +1.9 +0.7 +0.8 +1.8
Apr. 6, 1881 +1.2

Aug. 21, 1888 (7.9) +15.5 +2.1 +2.5
Aug. 21, 1888 (6.6) +10.2 +1.1 +4.3 +5.6 +4.2

Feb. 2, 1887 (18.3) +3.9 +3.0 +2.0 +1.0
Feb. 2, 1887 (41.0) +9.4 +4.5 +1.3

Feb. 9, 1886 (6.2) +0.3 +0.7 +0.8 +5.0 +11.6 +4.4 +0.0
Feb. 10, 1886 (14.1) +1.2 +6.3 +5.8 +3.3 +2.8 +3.5 +2.5 +1.0

Mar. 4, 1879 (15.0) +1.3 +1.2 +3.2 +2.3 +1.5 +1.0 +0.1 +2.2 +1.8
Mar. 7, 1879 (27.4) +0.2 +1.5 +2.6 +2.2 +2.4 +0.5 +0.5
Mar. 7, 1879 +0.7

Feb. 11, 1880 (6.5) +1.5 +7.8 +9.4 +5.3 +1.0
Feb. 11, 1880 (14.0) +1.1 +8.0 +14.7 +9.7 +4.5 +1.2

Dec. 9, 1878 (12.2) +2.2 +7.5 +7.1 +3.0
Dec. 11, 1878 (27.3) +2.5 +6.3 +3.8 +1.3

Feb. 8, 1887 (21.0) +4.3 +4.0 +2.6 +0.0 +0.4
Feb. 11, 1887 (44.3) +0.6 +0.0 +0.6 +1.5 +1.4 +0.0 +1.7

Feb. 8, 1881 (6.0) +4.0 +10.5 +8.9 +9.7
Feb. 7, 1881 (16.2) +5.6 +8.0 +5.0 −2.0 +5.4 +5.1 +4.7 +2.3 +0.2

Feb. 3, 1883 (11.0) +3.3 +11.2 +8.9 +2.1 +3.4 +3.7
Feb. 6, 1883 (29.4) +9.9 +11.5 +5.5 +2.4 +1.1 +3.1
Feb. 6, 1883 +1.7 +0.2 +1.4

Jan. 27, 1884 (6.5) +8.5 +3.0 +2.0 +1.5 +0.0 +4.0 +2.8 −3.1 +3.8 +8.7
Jan. 29, 1884 (15.8) +5.4 +11.2 +8.1 +6.6 +2.6 +0.6 +3.3

Jan. 27, 1884 +8.6 +3.2 +2.5
Jan. 29, 1884 +6.7 +1.5 +1.1 +1.1 +1.7 +1.9 +1.4 +1.0

The noticeable features of these differences are: first, that the highest point is reached by the high water two days after the differences begin to diminish; second, that the greatest daily difference at Cincinnati follows that at Marietta by two days.

On the whole, however, the differences can not be regarded as a safe criterion to go by in judging of what the river will do. It is only something to be considered in connection with other circumstances.

From the above it appears that the amount of the rise at Cincinnati is greater than that at Marietta for a low stage of water at Cincinnati and less than the Marietta rise when the Cincinnati stage is high. When the minimum point on the Cincinnati water-level, curve is 32 feet the subsequent rise to high water is usually about equal to the rise that takes place at Marietta between the corresponding low and high water, provided the rises are caused by general rainfalls occurring throughout the whole of the catchment basin of the Ohio above Cincinnati. For stages at Cincinnati lower than 32 feet there is a slow increase in the rise at Cincinnati as compared with the Marietta rise. Above the 32-foot stage the rise at Cincinnati usually diminishes very rapidly as compared with the corresponding Marietta rise.

The duration of a rise in the river at Cincinnati varies ordinarily from four to nine days. There is one case, that of January 29 to February 14, 1884, in which the rise continued sixteen days. The average time of a rise is 7.4 days.

In the following table are given the rainfalls exceeding 1 inch in twenty-four hours that have occurred at Cincinnati, Columbus, Marietta, and Pittsburg from July 1, 1877, to January 1, 1889, and the subsequent rises in the river at Cincinnati that may be presumed to have been caused by them:

TABLE OF HEAVY RAINFALLS IN EXCESS OF 1 INCH IN A DAY FOR THE TWENTY-FOUR HOURS ENDING AT 7 A. M. ON THE DATE GIVEN FOR CINCINNATI, COLUMBUS, AND PITTSBURG, AND 2 P. M. FOR MARIETTA, AND THE SUBSEQUENT CHANGE IN RIVER-GAUGE READINGS AT CINCINNATI.

Year.	Rainfall in inches at—				Cincinnati gauge.				
	Cincinnati.	Columbus.	Marietta.	Pittsburg.	Date.	River-gauge reading.	Date.	River-gauge reading.	Fall, —; rise, +.
1877.									
July 17			1.50		July 17	10.6	July 20	10.0	— 0.6
Dec. 30			1.36		Dec. 30	11.2	Jan. 2	17.8	+ 6.6
1878.									
Apr. 10	1.34				Apr. 9	16.1	Apr. 10	18.2	+ 2.1
June 10	2.06				June 9	9.7	June 14	9.8	+ 0.1
July 5				2.80	July 5	11.0	July 8	8.8	— 2.2
July 13	1.14				July 12	8.0	July 17	9.2	+ 1.2
July 30				1.10	July 30	6.2	Aug. 3	11.8	+ 5.6
Aug. 18	1.13				Aug. 17	9.3	Aug. 22	9.3	0.0
Sept. 12			1.70						
Sept. 13	.64		4.58	3.88	Sept. 12	5.4	Sept. 16	35.3	+29.9
Oct. 23			2.24	1.28	Oct. 23	4.3	Oct. 27	10.2	+ 5.9
Nov. 27			1.25						
Nov. 28				1.35	Nov. 27	24.0	Dec. 1	38.0	+14.0
1879.									
Mar. 22	1.87								
Mar. 23		1.54			Mar. 22	29.0	Mar. 27	36.1	+ 7.1
June 3			1.06		June 3	10.8	June 7	9.5	— 1.3
June 6				1.79	June 6	9.0	June 7	9.5	+ 0.5
June 11	1.34				June 10	7.8	June 13	9.2	+ 1.4
June 15		1.14			June 15	8.8	June 19	6.8	— 2.0
June 28	1.57				June 27	5.0	June 30	5.1	+ 0.1
June 29		1.13			June 28	5.0	July 2	5.0	0.0
July 11				1.35	July 11	5.8	July 14	5.0	— 0.8
July 12		1.04	1.42		July 12	5.9	July 16	5.0	— 0.9
July 24				1.04	July 23	6.8	July 26	5.2	— 1.6
July 30				1.05	July 29	4.2	July 31	4.5	+ 0.3
Aug. 1				1.04	July 31	4.5	Aug. 3	12.1	+ 7.6
Aug. 6	1.19				Aug. 6	9.1	Aug. 8	9.7	+ 0.6
Aug. 8	1.08								
Aug. 16	2.30				Aug. 15	10.0	Aug. 17	12.4	+ 2.4
Aug. 24	1.04				Aug. 23	5.8	Aug. 26	16.2	+10.4
Aug. 25	2.45		1.72	1.55	Aug. 24	6.5	Aug. 26	16.2	+ 9.7
Aug. 26				1.31	Aug. 25	10.5	Aug. 27	14.0	+ 3.5
Sept. 3	1.71				Sept. 2	10.7	Sept. 4	15.7	+ 5.0
Sept. 13	1.13		1.70		Sept. 13	6.2	Sept. 17	6.2	0.0
Nov. 15	1.51	1.37			Nov. 14	2.8	Nov. 16	3.7	+ 0.9
Dec. 22	1.34	1.13		1.27	Dec. 22	17.0	Dec. 27	42.8	+25.8
Dec. 24	1.93								
1880.									
Jan. 9	1.16				Jan. 8	39.9	Jan. 10	41.9	+ 2.0
Feb. 13	1.44				Feb. 12	15.1	Feb. 15	47.4	+32.3
Feb. 14			1.50		Feb. 14	37.8	Feb. 17	53.2	+15.4
Mar. 5			1.13		Mar. 5	27.7	Mar. 11	45.1	+17.4
Mar. 27	1.23		1.04		Mar. 27	20.5	Apr. 1	27.3	+ 6.8

TABLE OF HEAVY RAINFALLS IN EXCESS OF 1 INCH, ETC.—Continued.

Year.	Rainfall in inches at—				Cincinnati gauge.				
	Cincinnati.	Columbus.	Marietta.	Pittsburg.	Date.	River-gauge reading.	Date.	River-gauge reading.	Fall, —; rise, +.
1880.									
Apr. 4		1.77			Apr. 4	25.3	Apr. 6	28.5	+ 3.2
Apr. 16	1.93				Apr. 15	17.0	Apr. 17	19.2	+ 2.2
Apr. 24		1.26	2.20		Apr. 24	13.7	Apr. 29	45.4	+31.7
Apr. 26	1.52	1.53							
May 30	2.18	1.83	2.20		May 30	9.8	May 31	11.7	+ 1.9
June 10	1.40				June 9	10.5	June 11	10.8	+ 0.3
June 15	2.43	1.19			June 14	10.7	June 18	18.8	+ 8.1
June 26	1.27				June 26	12.6	June 30	11.1	— 1.5
July 11		2.35			July 10	11.0	July 12	11.9	+ 0.9
July 20	1.59				July 20	9.6	July 22	7.7	— 1.9
Aug. 4				1.14	Aug. 3	6.4	Aug. 6	5.9	— 0.5
Aug. 20		3.79	1.05	1.30	Aug. 20	8.9	Aug. 24	13.7	+ 4.8
Sept. 28				1.10	Sept. 27	4.7	Sept. 30	4.1	— 0.6
Oct. 16	1.27				Oct. 15	4.4	Oct. 18	5.1	+ 0.7
Nov. 7	1.13	1.70			Nov. 6	14.3	Nov. 8	16.5	+ 2.2
Dec. 5	3.11	2.20	2.10		Dec. 5	30.2	Dec. 8	37.0	+ 6.8
1881.									
Jan. 21	1.10				Jan. 20	20.5	Jan. 24	35.8	+15.3
Feb. 1	1.50			1.04	Jan. 31	16.3	Feb. 1	19.7	+ 3.4
Feb. 8	1.32				Feb. 7	16.2	Feb. 10	34.8	+18.6
Feb. 9	1.09				Feb. 8	21.8	Feb. 16	50.5	+28.7
Feb. 28	.95				Mar. 2	20.9	Mar. 7	29.4	+ 8.5
May 6				1.11	May 5	17.8	May 10	25.0	+ 7.2
May 15	1.21				May 14	19.3	May 18	14.3	— 5.0
June 8	1.33			1.35	June 7	7.8			
June 9				1.21					
June 10				1.79	June 15	35.0		27.2	
June 14	1.90	1.75							
June 19	1.16				June 19	20.3	June 20	17.7	— 2.6
June 30	1.00				June 30	12.4	July 1	11.2	— 1.2
July 13		1.21			July 13	6.0	July 19	6.8	+ 0.8
July 14			2.05		July 14	5.8	July 19	6.8	+ 1.0
July 15	1.71				July 15	5.9	July 19	6.8	+ 0.9
July 17				.98	July 17	6.0	July 19	6.8	+ 0.8
July 19					July 19	6.8	July 25	7.3	+ 0.5
July 21		1.31			July 20	6.5	July 25	7.3	+ 0.8
July 22			1.60		July 22	6.7	July 26	7.9	+ 1.2
July 30					July 29	9.3	July 30	10.8	+ 1.5
Aug. 7		1.32			Aug. 6	5.5	Aug. 9	5.5	0.0
Oct. 2		2.78			Oct. 1	4.1	Oct. 3	7.0	+ 2.9
Oct. 3	1.71	1.47			Oct. 2	4.8	Oct. 6	3.8	— 1.0
Nov. 19	1.67	1.85		1.07	Nov. 18	11.8	Nov. 24	26.8	+15.0
Dec. 13				1.83	Dec. 12	12.2	Dec. 18	33.7	+21.5
Dec. 14	1.09	1.29							
Dec. 15			2.20		Dec. 15	17.8	Dec. 18	33.7	+15.9
Dec. 21	1.60				Dec. 20	31.5	Dec. 23	36.7	+ 5.2
Dec. 22		1.14			Dec. 21	32.7	Dec. 23	36.7	+ 4.0
1882.									
Jan. 5	1.01				Jan. 6	26.7	Jan. 10	37.6	+10.9
Jan. 11			1.08		Jan. 11	40.8	Jan. 16	48.5	+ 7.7
Jan. 13	1.06				Jan. 12	42.2	Jan. 16	48.5	+ 6.3
Jan. 26	1.03		1.69		Jan. 26	42.3	Jan. 31	47.7	+ 5.4
Feb. 13	1.22		1.20		Feb. 13	44.6	Feb. 17	49.0	+ 4.4
Feb. 20	1.52	1.79	1.50		Feb. 19	52.9	Feb. 21	58.6	+ 5.7

TABLE OF HEAVY RAINFALLS IN EXCESS OF 1 INCH, ETC.—Continued.

Year.	Rainfall in inches at—				Cincinnati gauge.				
	Cincinnati.	Columbus.	Marietta.	Pittsburg.	Date.	River-gauge reading.	Date.	River-gauge reading.	Fall, —; rise, +.
1882.									
Feb. 21	1.78	1.43							
Mar. 16			1.25		Mar. 16	30.7	Mar. 21	39.6	+ 8.9
Mar. 21	2.43	2.01	1.40		Mar. 20	28.3	Mar. 24	46.9	+18.6
Apr. 23		1.22			Apr. 22	13.2	Apr. 27	17.5	+ 4.3
Apr. 27		0.97	1.45		Apr. 27	17.5	Apr. 30	24.2	+ 6.7
May 5	1.01	1.73			May 5	19.6			
May 6	1.17	1.12	1.14				May 10	30.7	+11.1
May 13		1.18	1.55		May 13	36.8	May 16	46.4	+ 9.6
May 28	2.47	1.26			May 27	31.9	June 2	39.6	+ 7.7
June 1		0.99	1.65		May 31	31.8	June 2	39.6	+ 7.8
June 12			1.00		June 12	20.0	June 15	35.0	+15.0
June 14			1.30		June 13	18.4	June 15	35.0	+16.6
June 17	0.82			1.44	June 17	31.3	June 20	21.8	— 9.5
June 26		2.26	1.45		June 27	17.9	June 29	20.0	+ 2.1
June 28			1.20		June 27	17.9	July 3	25.0	+ 7.1
July 11		1.44	1.20		July 10	19.0	July 13	20.8	+ 1.8
July 17				1.19	July 17	18.1	July 22	12.8	— 5.7
July 18			1.04		July 18	16.8	July 22	12.8	— 4.0
Aug. 1	1.18		1.80		July 31	9.3	Aug. 2	19.0	+ 9.7
Aug. 24	1.27				Aug. 23	8.8	Aug. 24	9.7	+ 0.9
Aug. 27		1.00		1.04	Aug. 26	8.9	Aug. 31	11.6	+ 2.7
Aug. 28	1.85				Aug. 28	9.1	Sept. 4	15.8	+ 6.7
Sept. 14	1.01				Sept. 12	11.8	Sept. 15	18.8	+ 7.0
Oct. 6	1.10				Oct. 6	13.1	Oct. 10	10.0	— 3.1
Oct. 29			1.30		Oct. 29	6.6	Nov. 3	7.6	+ 1.0
Dec. 6		0.97	1.05		Dec. 5	8.1	Dec. 10	12.0	+ 3.9
1883.									
Feb. 4	1.40	1.39			Feb. 3	27.2	Feb. 5	32.0	+ 4.8
Feb. 7	3.11	1.29	1.50	1.34	Feb. 6	29.4	Feb. 10	58.8	+29.4
Feb. 11	1.95		1.50		Feb. 10	58.8	Feb. 15	66.3	+ 7.5
Feb. 15		0.98			Feb. 14	64.9	Feb. 15	66.3	+ 1.4
Feb. 25	1.09				Feb. 25	42.7	Mar. 1	28.8	—13.9
Mar. 30	1.73				Mar. 29	16.9	Apr. 3	43.3	+26.4
May 15				1.20	May 15	12.5	May 18	11.5	— 1.0
May 21	1.07	1.37		0.92	May 20	13.1	May 24	23.9	+10.8
May 22	1.07				May 22	17.8	May 24	23.9	+ 6.1
May 29	1.52				May 28	26.5	May 30	27.3	+ 0.8
June 11		1.11			June 11	18.8	June 15	19.4	+ 0.6
June 19				1.23	June 18	23.4	June 20	23.8	+ 0.4
July 7				1.18	July 7	13.1	July 10	11.4	— 1.7
July 24				1.44	July 24	12.4	July 26	10.5	— 1.9
Aug. 29		1.40		2.11	Aug. 29	5.2	Aug. 31	4.9	— 0.3
Sept. 30		0.95			Sept. 29	4.9	Oct. 2	6.5	+ 1.6
Oct. 2	1.59	1.08			Oct. 1	6.2	Oct. 6	5.9	— 0.3
Oct. 5	1.95	1.66			Oct. 5	5.7	Oct. 11	11.8	+ 6.1
Oct. 29	4.06				Oct. 28	5.8	Nov. 1	18.2	+12.4
Oct. 30		1.55	1.35		Oct. 29	10.0	Nov. 1	18.2	+ 8.2
Nov. 22	2.23	1.48			Nov. 21	12.4	Nov. 23	21.2	+ 8.8
Dec. 24	2.60	1.63		1.47	Dec. 23	11.2	Dec. 28	49.5	+38.3
1884.									
Jan. 9				1.95	Jan. 9	23.8	Jan. 17	23.8	+ 0.0
Feb. 5	1.39		1.05		Feb. 4	50.2	Feb. 9	64.0	+13.8
Feb. 6	2.50	1.34		1.07	Feb. 5	53.5	Feb. 14	71.1	+17.6
Feb. 7	0.87				Feb. 7	61.8	Feb. 14	71.1	+ 9.3

TABLE OF HEAVY RAINFALLS IN EXCESS OF 1 INCH, ETC.—Continued.

Year.	Rainfall in inches at—				Cincinnati gauge.				
	Cincinnati.	Columbus.	Marietta.	Pittsburg.	Date.	River-gauge reading.	Date.	River-gauge reading.	Fall, —; rise, +.
1884.									
Feb. 20	1.13				Feb. 20	58.4	Feb. 25	40.2	—18.2
Apr. 2		1.01			Apr. 2	30.6	Apr. 6	31.8	+ 1.2
May 14		2.04			May 13	19.8	May 15	22.4	+ 2.6
June 29		1.23			June 28	7.9	July 2	14.8	+ 6.9
July 29				1.02	July 28	5.0	Aug. 6	12.5	+ 7.5
Aug. 17				1.94	Aug. 17	5.8	Aug. 23	5.5	— 0.3
Sept. 25	1.31				Sept. 25	2.8	Sept. 30	3.8	+ 1.0
Sept. 29		1.01			Sept. 28	3.3	Oct. 1	3.9	+ 0.6
Dec. 12	1.27				Dec. 12	7.6	Dec. 15	16.2	+ 8.6
1885.									
Jan. 6			1.50		Jan. 5	19.8	Jan. 7	25.3	+ 5.5
Jan. 16	1.69	1.05	2.23	1.04	Jan. 15	25.0	Jan. 20	46.0	+21.0
Jan. 17	0.75								
Apr. 18		1.83			Apr. 17	27.6	Apr. 21	36.8	+ 9.2
May 22			1.50		May 24	10.7	May 28	16.5	+ 5.8
June 21		1.70			June 20	10.2	June 28	12.7	+ 2.5
June 22		1.22		1.41	June 21	9.9	June 28	12.7	+ 2.8
July 25		1.21			July 24	6.8	July 27	7.1	+ 0.3
Aug. 3		1.29	5.20	1.96	Aug. 2	8.8	Aug. 10	16.2	+ 7.4
Aug. 7	2.62	1.31			Aug. 6	10.6	Aug. 10	16.2	+ 5.6
Aug. 23	1.04				Aug. 23	12.2	Aug. 27	10.1	— 2.1
Sept. 9	1.20	1.31		0.96	Sept. 8	10.2	Sept. 12	9.9	— 0.3
Oct. 4			2.03		Oct. 4	5.1	Oct. 8	4.4	— 0.7
Oct. 13		0.57	2.05	1.30	Oct. 12	3.9	Oct. 20	17.0	+13.1
1886.									
Jan. 4		1.07	1.36		Jan. 3	14.2	Jan. 9	39.1	+24.9
Jan. 9			1.00		Jan. 9	39.1	Jan. 14	20.8	—18.3
Jan. 16		1.10			Jan. 15	17.8	Jan. 24	29.1	+11.3
Mar. 31		1.08			Mar. 30	39.3	Apr. 6	54.2	+14.9
Apr. 6			1.10	2.35	Apr. 5	53.8	Apr. 9	55.8	+ 2.0
May 13	1.10	2.23	2.10	0.92	May 12	32.0	May 16	36.8	+ 4.8
May 25		1.02			May 25	16.8	May 28	15.9	— 0.9
May 31		1.75			May 31	12.8	June 4	15.4	+ 2.6
June 9	1.01				June 9	10.4	June 15	12.9	+ 2.5
June 17				1.76	June 16	12.2	June 20	15.6	+ 3.4
June 23				1.10	June 22	19.8	June 24	20.5	+ 0.7
July 14				1.53	July 12	12.5	July 14	13.0	+ 0.5
July 27			1.70	2.10	July 27	9.6	July 31	8.4	— 1.2
July 31		3.19			July 30	8.4	Aug. 4	10.8	+ 2.4
Aug. 15		1.13			Aug. 14	7.4	Aug. 17	13.2	+ 5.8
Aug. 17	1.14				Aug. 16	7.2	Aug. 18	13.0	+ 5.8
Aug. 28					Aug. 28	8.3	Aug. 31	7.2	— 1.1
Aug. 30			1.48		Aug. 30	7.3	Sept. 3	6.6	— 0.7
Sept. 17				1.34	Sept. 16	4.3	Sept. 21	5.0	+ 0.7
Sept. 28		1.25		0.91	Sept. 27	5.8	Sept. 29	6.7	+ 0.9
Nov. 13				1.00	Nov. 12	4.0	Nov. 18	11.2	+ 7.2
Nov. 18		0.93		1.03	Nov. 17	6.8	Nov. 24	29.7	+22.9
1887.									
Jan. 29			1.10		Jan. 28	36.0	Jan. 30	43.0	+ 7.0
Feb. 2			1.20						
Feb. 3		1.03	1.40		Feb. 2	42.7	Feb. 5	56.2	+13.5
Feb. 11				1.03	Feb. 11	44.3	Feb. 16	48.4	+ 4.1
Feb. 18		1.17			Feb. 17	48.0	Feb. 19	49.3	+ 1.3
Feb. 26			1.10		Feb. 25	44.0	Feb. 28	53.6	+ 9.6

TABLE OF HEAVY RAINFALLS IN EXCESS OF 1 INCH, ETC.—Continued.

Year.	Rainfall in inches at—				Cincinnati guage.				
	Cincinnati.	Columbus.	Marietta.	Pittsburg.	Date.	River-guage reading.	Date.	River-guage reading.	Fall, —; rise, +.
1887.									
Apr. 18	1.50	------	1.61	------	Apr. 17	11.8	Apr. 19	22.2	+10.4
Apr. 22	------	------	1.04	------	Apr. 20	21.7	Apr. 25	49.5	+27.8
Apr. 23	0.98	------	------	------	Apr. 22	28.9	Apr. 25	49.5	+20.6
April 29	------	------	------	1.05	Apr. 29	38.0	Apr. 31	35.2	— 2.8
June 1	------	------	1.22	------	May 31	9.8	June 6	17.8	+ 8.0
July 10	------	------	------	1.62	July 10	5.3	July 15	6.8	+ 1.5
July 21	------	------	------	3.84	July 21	4.6	July 24	4.7	+ 0.1
Aug. 1	------	------	------	1.00	Aug. 1	5.8	Aug. 24	6.0	+ 0.2
Aug. 5	0.94	------	------	------	Aug. 5	6.0	Aug. 10	5.9	— 0.1
1888.									
Jan. 1	1.04	1.04	------	1.42	Dec. 31	7.1	Jan. 2	13.8	+ 6.7
Jan. 7	------	1.44	1.27	1.20	Jan. 5	8.8	Jan. 13	34.4	+25.6
Mar. 21	1.26	------	------	------	Mar. 20	17.1	Mar. 25	23.0	+ 5.9
Apr. 10	------	------	1.29	------	Apr. 9	22.3	Apr. 12	33.0	+10.7
May 9	------	1.08	------	------	May 9	9.9	May 13	10.3	+ 0.4
June 28	------	1.14	1.00	------	June 27	6.5	June 30	8.1	+ 1.6
July 8	------	------	1.10	------	July 8	9.1	July 15	31.5	+22.4
July 9	------	2.00	2.25	.86	------	------	------	------	------
July 10	------	1.36	5.35	.70	------	------	------	------	------
July 17	1.06	------	------	------	July 15	31.5	July 20	16.9	—14.6
July 21	1.98	------	------	------	July 21	14.4	July 26	11.3	+ 3.1
Aug. 17	1.06	0.98	------	1.66	Aug. 16	6.3	Aug. 19	7.4	— 1.1
Aug. 19	------	------	2.03	------	Aug. 18	6.1	Aug. 21	6.6	+ 0.5
Aug. 21	------	------	1.90	------	Aug. 21	6.6	Aug. 22	16.8	+10.2
Aug. 22	------	------	2.22	------	Aug. 22	16.8	Aug. 26	32.0	+15.2
Aug. 28	------	------	2.00	------	Aug. 27	31.6	Aug. 31	16.8	—14.8
Sept. 8	------	------	1.70	------	Sept. 7	13.2	Sept. 12	19.4	+ 6.2
Sept. 16	1.00	------	1.80	------	Sept. 15	20.5	Sept. 18	15.1	— 5.4
Oct. 3	1.08	------	------	------	Oct. 3	7.6	Oct. 9	7.9	+ 0.3
Oct. 9	1.28	------	------	------	Oct. 8	7.2	Oct. 14	12.6	+ 5.4
Nov. 3	------	------	1.10	------	Nov. 2	26.3	Nov. 6	23.2	— 3.1

In the following table are given the changes in the stage of the river at Cincinnati, arranged according to the magnitude of the rainfall at any of the places, Cincinnati, Columbus, Marietta, or Pittsburg.

Where the sign is minus (—), it indicates a fall of the river.

It will be seen from this table that the rainfall at so few places can be of little value, unless taken in connection with other things, in giving any idea of what the subsequent rise in the river is going to be. There are cases where the river rises associated with rainfalls between 1 inch and 1.5 inches are 22.9, 27.8, 25.6, 27.2, and 24.9 feet, while there are other cases where there are falls in the river of 18.2, 18.3, 13.9 feet, etc., associated with equally large rainfalls. In the three cases where there are rainfalls between 2.5 and 3 inches the rise varies from 3.1 to 38.3 feet. For the two cases of rainfall between 3 and 3.5 inches the rises are 2.4 and 29.4 feet. For the two rainfalls over 5 inches the rises are 7.4 and 22.4 feet.

This is of course due to the fact that all consideration of the area over which the rainfall has occurred is left out of account. It depends to some extent on the stage of the water, a small rise at a high stage corresponding to a greater rise at a low stage. It would seem to indicate that an excessive rainfall at a place, 1.5 to 2 inches, does not usually extend over a wide area; otherwise it would be certain to cause greater rises in the river than are found to occur. It is probably true that in general rain storms excessive rainfall at any one place must be at the expense of the rainfall of adjoining places.

RIVER RISES AT CINCINNATI IN FEET FOR VARIOUS DEPTHS OF RAINFALLS AT POINTS IN CATCHMENT BASIN.

RAINFALLS.

[1 to 1.5 inches.]

6.6	2.1	1.2	5.7	0.0	14.0	—1.3	1.4	—2.0	0.0	—0.8	—0.9	—1.6	0.3
7.6	0.6	10.4	3.5	2.0	32.3	17.4	6.8	0.3	—1.5	—0.5	—0.6	0.7	15.3
3.4	8.6	28.7	8.5	7.2	—5.0	27.2	—2.6	—1.2	0.8	0.8	0.0	10.9	7.7
6.3	4.4	8.9	4.3	6.7	10.9	15.0	16.6	—9.5	7.1	1.8	4.0	0.9	2.7
7.0	3.1	1.0	3.9	4.8	13.9	1.0	10.8	6.1	0.6	1.7	1.9	1.6	8.2
13.8	18.2	1.2	7.5	0.3	0.6	9.8	2.8	0.3	—2.1	—0.3	24.9	—18.3	11.3
14.9	—0.9	2.5	0.7	5.8	5.8	—0.7	0.7	0.9	7.2	22.9	7.0	15.2	15.2
15.2	3.9	1.3	11.4	27.8	20.6	—0.2	8.0	—0.1	6.7	25.6	5.9	10.7	1.6
—14.6	0.3	— 5.4	— 3.1	----	----	----	----	----	----	----	----	----	----

[1.5 to 2 inches.]

—0.6	7.1	7.1	0.5	0.2	5.0	0.0	0.9	25.8	15.4	3.2	2.2	—1.9	2.2
7.0	0.9	1.2	—1.0	15.0	21.5	5.2	5.4	2.2	5.7	11.1	9.6	7.8	9.7
—6.7	7.5	26.4	0.8	—0.3	6.1	0.0	1.0	5.5	9.2	5.8	2.5	2.6	3.4
—1.2	11.2	1.5	—3.1	1.1	10.2	6.2	—5.4	----	----	----	----	----	----

[2 to 2.5 inches.]

0.1	5.9	2.4	9.7	31.7	1.9	8.1	0.9	1.0	15.9	18.6	7.7	2.1	—0.3
8.8	2.6	21.0	—0.7	13.1	2.0	4.8	0.5	15.2	—14.8	----	----	----	----

[2.5 to 3 inches.]

—2.2	3.1	38.3	5.7	17.6

[3 to 3.5 inches.]

29.4	2.4	6.8

[3.5 to 4 inches.]

0.1	4.8

[4 to 5 inches.]

29.9	12.4

[5 + inches.]

7.4	22.4

The following table contains the river rises associated with rainfalls of over 1 inch occurring at more than two of the above places:

RIVER RISES AT CINCINNATI.

Date.	Rise.	Date.	Rise.
	Feet.		*Feet.*
June 7 to 15, 1881	27.2	Jan. 15 to 20, 1885	21.0
Nov. 18 to 24, 1881	15.0	Aug. 2 to 10, 1885	7.4
Feb. 19 to 21, 1882	*5.7	Sept. 8 to 12, 1885	‡0.3
Mar. 20 to 24, 1882	18.6	May 12 to 16, 1886	4.8
May 5 to 19, 1882	10.9	Dec. 31 to Jan. 1, 1888	6.7
Feb. 6 to 10, 1883	29.4	Jan. 5 to 13, 1888	25.6
May 20 to 24, 1883	10.8	July 8 to 15, 1888	22.4
Dec. 23 to 28, 1883	38.3	Aug. 16 to 19, 1888	1.1
Feb. 6 to 14, 1884	†17.6		

* 52.9 to 58.6. † 53.5 to 71.1. ‡ Fall.

Nothing very definite can be inferred from these figures. In general it can be said that a rainfall of more than 1 inch in twenty-four hours at three or more widely separated stations will cause a rise in the river at Cincinnati of about 16 feet on the average in the five days following for medium stages of water.

When there is a rise at Cincinnati associated with a rise at Marietta and an extensive rainstorm of this sort covers the valley below Marietta, the water stage at Cincinnati will be more likely to attain one of its maximum stages than otherwise.

There are two notably heavy and widely extended rainstorms which caused large rises in the Ohio River at Cincinnati, that of September 12 to 14, 1878, and May 31 to June 1, 1889.

Rainfall September 12, 13, and 14, 1878.

Cincinnati	0.64
Marietta	6.28
Pittsburg	4.48
Cleveland	4.83
Erie	2.52
Buffalo	2.05

The river rise at Cincinnati was 29.9 feet. September 12, 5.4 feet; September 16, 35.3 feet.

Rainfall May 30 to June 1, 1889.

Cincinnati	0.10
Marietta	1.49
Columbus	0.76
Erie	0.72
Pittsburg	1.44
Cleveland	2.34
Buffalo	1.93

The densest part of this rainfall of June, 1889, was in the mountainous part of the drainage area of the Ohio River basin above Pittsburg, where the rainfall was in some places as high as 6 inches (see Weather Review for May, 1889). The rise of the river at Cincinnati May 29 from 12.3 to June 6, 33.6, was 21.3 feet. At Parkersburg May 30 from 6.5 to June 3, 23.8 the rise was 17.3; at Pittsburg May 31 from 4.3 to June 2, 21.8, the rise was 17.5 feet.

The extent to which heavy rainfall at Cincinnati influences the stage of water in the river is shown by the following list of rises which have occurred in a single day and the accompanying rainfalls.

The table shows that the steepest rises are not associated with heavy local rainfall. For instance, the rainfall of September 14, 1878, was only 0.64 inch at Cincinnati, while the river rose in a single day 22.3 feet, the greatest daily rise ever known. This rise was undoubtedly caused by the heavy rainfalls farther up the river. At Marietta 6.28 inches of rain fell September 12, 13, 1878; at Pittsburg, 4.48; at Cleveland, 4.83.

Date.	Gauge reading, Cincinnati.	Rise in twenty-four hours.	Rainfall at Cincinnati. Inches.
Dec. 21, 1865	11.8	17.8	
Dec. 22, 1865	29.6	7.1	
Nov. 26, 1877	8.9	13.7	0.4
Nov. 27, 1877	22.6	7.6	
Sept. 14, 1878	5.3	22.2	0.6
Sept. 15, 1878	27.5	7.7	
Dec. 23, 1883	11.2	11.2	3.7
Dec. 24, 1883	22.5	13.1	
Dec. 25, 1883	35.6	8.1	
Feb. 5, 1884	53.5	6.7	2.5
Mar. 11, 1884	40.9	6.8	0.8
Dec. 12, 1884	7.6	5.6	1.3
Jan. 15, 1885	25.0	9.4	2.2
Jan. 16, 1885	34.4	6.7	0.8
Dec. 13, 1885	14.2	6.4	0.5
Nov. 17, 1886	6.7	4.5	0.9
Nov. 22, 1886	18.0	5.5	0.7
Nov. 23, 1886	23.5	6.2	0.7
Apr. 22, 1887	28.9	16.6	2.0
Jan. 7, 1888	15.3	5.0	0.8
Feb. 4, 1888	9.3	5.0	0.5
Aug. 21, 1888	6.6	10.2	2.7

The following table contains a list of excessive rainfalls at Cincinnati amounting to 2.5 inches or more occurring in twenty-four hours, and the associated changes in the river. Camp Dennison, College Hill, and Mount Auburn are places near Cincinnati. As a rule a fall of 2.5 inches of rain at Cincinnati causes a rise in the river of 8 feet within two days.

EXCESSIVE RAINFALLS AT CINCINNATI AND ACCOMPANYING RIVER RISES.

Locality.	Rainfall in twenty-four hours.		Gauge readings.				Difference in feet.
	Date.	Inches.	Date.	Feet.	Date.	Feet.	
Camp Dennison (near Cincinnati).	Sept. 3, 4, '64	4.80	Sept. 3	11.8	Sept. 5	18.3	+ 6.8
Cincinnati	Dec. 31, '71	2.50	Dec. 31	10.8	Jan. 1	16.8	+ 6.0
	Dec. 12, 13, '73	2.75	Dec. 12	28.8	Dec. 14	36.4	+ 7.6
	Feb. 21, '74	2.73	Feb. 21	30.1	Feb. 23	38.8	+ 8.7
College Hill (near Cincinnati).	June 21, '75	3.00	June 20	10.8	June 22	17.2	+ 6.4
	July 22, '75	2.50	July 21	24.8	July 23	32.8	+ 8.0
	Nov. 14, '75	2.50	Nov. 13	15.6	Nov. 14	16.2	+ 0.6
Cincinnati	Jan. 17, 18, '76	2.97	Jan. 18	19.9	Jan. 19	28.1	+ 8.2
	Oct. 22, 23, '76	2.64	Oct. 22	7.2	Oct. 24	12.5	+ 5.3
College Hill	July 2, '78	2.50	July 2	12.4	July 4	11.8	— 0.6
Cincinnati	May 25, 26, '79	2.98	May 26	12.9	May 27	14.1	+ 1.2
College Hill	May 26, '79	3.00	May 26	12.9	May 27	14.1	+ 1.2
Mount Auburn (near Cincinnati).	May 26, '79	3.23	May 26	12.9	May 27	14.1	+ 1.2

EXCESSIVE RAINFALL AT CINCINNATI, ETC.—Continued.

Locality.	Rainfall in twenty-four hours.		Gauge readings.				Difference in feet.
	Date.	Inches.	Date.	Feet.	Date.	Feet.	
College Hill	Aug. 15, '79	3.00	Aug. 15	10.0	Aug. 17	12.4	+ 2.4
	Aug. 24,25, '79	2.50	Aug. 24	6.5	Aug. 26	16.2	+ 9.7
Cincinnati	Aug. 24,25, '79	2.87	Aug. 24	6.5	Aug. 26	16.2	+ 9.7
Mount Auburn	May 10, 11, '80	2.82	May 10	16.9	May 12	15.1	— 1.8
Cincinnati	May 11, '80	0.14	May 10	16.9	May 12	15.1	— 1.8
	June 14, 15, '80	3.12	June 13	9.1	June 16	18.0	+ 8.9
Mount Auburn	June 14, 15, '80	3.80	June 13	9.1	June 16	18.0	+ 8.9
College Hill	June 14, '80	3.00	June 13	9.1	June 16	18.0	+ 8.9
Mount Auburn	Aug. 23, '80	2.95	Aug. 22	12.8	Aug. 24	13.7	+ 0.9
Cincinnati	Dec. 4, 5, '80	3.10	Dec. 4	21.8	Dec. 6	35.9	+14.1
College Hill	Dec. 4, 5, '80	3.50	Dec. 4	21.8	Dec. 6	35.9	+14.1
	June 7, 8, '81	2.50	June 7	7.8	June 9	10.7	+ 2.9
Cincinnati	Nov. 19, '81	2.50	Nov. 19	15.8	Nov. 21	12.7	— 3.1
College Hill	Jan. 4, '82	2.50	Jan. 4	35.1	Jan. 6	26.7	— 8.4
Cincinnati	Mar. 19, 20, '82	2.54	Mar. 19	25.8	Mar. 21	39.6	+13.8
	Oct. 28, 29, '83	3.06	Oct. 28	5.8	Nov. 1	18.2	+12.4
	Dec. 23, 24, '83	2.60	Dec. 23	11.2	Dec. 25	35.6	+24.4
	Feb. 5, 6, '84	2.50	Feb. 5	53.5	Feb. 7	61.8	+ 8.3
	Aug. 6, 7, '85	2.62	Aug. 6	10.6	Aug. 10	16.2	+ 5.6
College Hill	Aug. 17, '86	2.90	Aug. 16	7.2	Aug. 17	13.2	+ 6.0
Cincinnati	Feb. 23, '87	2.98	Feb. 24	41.7	Feb. 28	54.6	+12.9
College Hill	Aug. 20, 21, '88	3.75	Aug. 21	6.6	Aug. 26	32.0	+25.4
	Sept. 15, 16, '88	3.75	Sept. 14	19.7	Sept. 15	20.5	+ 0.8

The following are heavy rainfalls of 2.5 inches or over occurring in twenty-four hours at Portsmouth previous to 1858, the year in which river-gauge readings at Cincinnati were begun:

RAINFALLS IN TWENTY-FOUR HOURS AT PORTSMOUTH, OHIO.

Date.	Amount.	Date.	Amount.	Date.	Amount.
	Inches.		*Inches.*		*Inches.*
Aug. 18, 1832	3.60	July 27, 1837	4.20	July 11, 1843	3.20
Jan. 12, 1834	3.20	Sept. 8, 1837	3.30	July 30, 1843	2.60
Jan. 16, 1834	2.50	Oct. 26, 1837	2.90	Nov. 1, 1846	3.38
Nov. 23, 1835	3.20	Sept. 8, 1839	3.10	Aug. 9, 1850	2.60
Nov. 26, 1836	2.90	Apr. 29, 1840	2.90	Aug. 1, 1855	3.00
June 19, 1837	2.90	June 26, 1840	4.60		

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The following table gives the dates on which excessive rainfall occured at two or more stations in the State of Ohio, the means of the rainfalls, and the change in the river at Cincinnati:

Excessive rainfall over wide area.			River-gauge reading at Cincinnati.				Change in river in feet.
Date.	Inches.	Stations.	Date.	Feet.	Date.	Feet.	
Aug. 2, 1875	3.2	2	Aug. 1	37.0	Aug. 6	55.3	18.3
June 5, 6, 1877	4.2	2	June 6	7.8	June 15	16.9	9.1
June 20, 21, 1877	5.0	2	June 21	13.0	June 24	16.7	3.7
July 26, 1878	3.1	2	July 30	6.2	Aug. 4	14.0	7.8
Sept. 11, 13, 1878	5.2	2	Sept. 13	5.2	Sept. 17	35.9	30.7
Aug. 19, 20, 1880	4.6	2	Aug. 19	7.0	Aug. 24	13.7	6.7
Nov. 18, 19, 1881	2.7	2	Nov. 18	11.8	Nov. 24	26.8	15.0
Aug. 2, 3, 1885	3.8	3	Aug. 2	8.8	Aug. 10	16.2	7.4
Sept. 8, 1885	3.0	4	Sept. 8	10.2	Sept. 15	15.4	5.2
Aug. 16, 1886	2.8	2	Aug. 16	7.2	Aug. 17	13.2	6.0
Aug. 17, 1886	3.3	2					
Sept. 23, 1886	3.9	3	Sept. 23	4.8	Sept. 29	6.7	1.9
July 8, 9, 1888	3.8	5	July 8	8.8	July 15	31.5	22.7
Aug. 20, 21, 1888	3.6	5	Aug. 21	6.6	Aug. 26	32.0	25.4

This table shows that as a rule excessive rainfall of 2.5 inches or more in twenty-four hours occurring at three stations in Ohio, 60 miles or more apart, will be followed by a great rise in the river at Cincinnati within a week.

There are exceptions to the rule, for instance, the rainfalls of September 23, 1886, are followed by a rise of only 2 feet. It must be in this case that the heavy rainfalls did not cover the country between the stations.

In the following tables are given the stages during the principal river rises at Cincinnati since 1873, and those corresponding at Marietta, Charleston, and Louisa.

Cincinnati.		Marietta.		Charleston, W. Va.		Louisa, Ky.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1873.							
May 3	22.2	30	9.8				
May 6	28.8	3	11.8	3	......		
May 9	38.0	6	24.2	6	......		
Oct. 27	18.8	24	15.2				
Oct. 30	22.0	27	14.8	24	4.2		
Nov. 2	23.9	30	18.2	27	4.8		
Dec. 12	28.8	9	13.0				
Dec. 15	35.7	12	25.5	12	7.6		
Dec. 18	44.4	15	38.8	15	7.7		
1874.							
Jan. 7	26.5	3	7.5				
Jan. 10	41.4	6	16.5	6	9.7		
Jan. 13	46.8	9	37.8	9	16.3		
Jan. 21	22.3	18	8.0				
Jan. 24	31.0	21	13.0	21	9.0		
Jan. 27	35.9	24	23.5	24	8.2		

Cincinnati.		Marietta.		Charleston, W. Va.		Louisa, Ky.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1873.							
Feb. 13	16.3	10	6.2				
Feb. 16	24.1	13	7.0	13	5.4		
Feb. 19	31.9	16	22.0	16	10.0		
Feb. 20	31.4	18	18.5				
Feb. 23	38.8	21	11.0	21	5.9		
Feb. 26	44.0	24	27.6	24	6.0		
Mar. 19	16.3	16	8.2				
Mar. 22	22.9	19	8.4	19	5.0		
Mar. 25	28.8	22	17.8	22	11.3		
Apr. 27	31.9	23	19.2				
Apr. 30	44.5	26	19.8	26	23.2		
May 2	46.0	29	25.6	29	15.8		
Dec. 28	16.1	25	8.5				
Dec. 31	22.7	28	6.7	28	6.6		
1875.							
Jan. 3	33.2	31	25.5	31	9.8		
Feb. 24	13.6	21	5.5				
Feb. 27	28.1	24	7.8	24	4.9		
Mar. 2	42.6	27	19.9	27	31.8		
Mar. 14	32.9	11	11.8				
Mar. 17	36.6	14	19.9	14	9.6		
Mar. 20	41.5	17	29.1	17	11.2		
July 11	14.6	10	4.4	11	7.0		
July 14	23.8	13	4.8				
July 17	36.6	16	5.1	14	20.0		
July 18	Fall'g						
July 21	24.8	21	6.7				
July 25	37.8						
July 31	34.8						
Aug. 3	47.9	31	------	31	9.3		
Aug. 6	55.3	3	35.1	3	30.3		
Nov. 21	14.8	18	9.7				
Nov. 24	14.4	21	7.7	21	5.6		
Nov. 27	20.8	24	11.0	24	10.2		
Dec. 24	11.6	21	5.5				
Dec. 27	33.3	24	16.8	24	5.6		
Dec. 30	47.7	27	33.9	27	8.8		
1876.							
Jan. 23	35.2	20	17.9				
Jan. 26	44.8	23	20.5	23	8.0		
Jan. 29	51.8	26	21.7	26	11.8		
Feb. 10	32.2	7	12.3				
Feb. 13	38.8	10	19.5	10	7.8		
Feb. 16	44.9	13	31.2	13	10.4		
Mar. 15	26.6	12	15.9				
Mar. 18	28.2	15	14.6	15	6.9		
Mar. 21	31.2	18	18.6	18	9.5		

Cincinnati.		Marietta.		Charleston, W. Va.		Louisa, Ky.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1876.							
Mar. 25	25.8	23	11.2				
Mar. 28	34.2	26	18.2	26	8.9		
Mar. 31	40.3	29	22.8	29	11.0		
1877.							
Jan. 14	32.4	10	7.7				
Jan. 17	46.5	13	8.8	13	13.0		
Jan. 20	53.2	16	28.0	16	33.3		
Mar. 11	24.8	7	12.5				
Mar. 14	38.3	10	22.0	10	7.5		
Mar. 17	39.7	13	25.9	13	7.7		
Mar. 23	28.8	20	12.0				
Mar. 26	30.4	23	16.8	23	7.4		
Mar. 29	43.0	26	21.2	26	6.4		
Nov. 23	8.5	20	5.8				
Nov. 26	8.9	23	5.8	23	3.8		
Nov. 29	31.7	26	21.2	26	26.8		
1878.							
Jan. 12	8.6	10	4.5				
Jan. 15	26.8	13	14.2	13	14.3		
Jan. 18	28.8	16	17.9	16	11.6		
Feb. 22	22.4	19	11.2				
Feb. 25	25.8	22	12.4	22	7.2		
Feb. 28	32.0	25	22.7	25	13.4		
Mar. 11	22.7	8	12.9				
Mar. 14	29.8	11	11.2	11	7.0		
Mar. 17	33.3	14	16.0	14	16.0		
Apr. 27	12.2	25	8.0				
Apr. 30	23.2	28	13.7	28	8.8		
May 3	30.8	1	16.8	1	12.0		
Nov. 25	16.8	23	11.2				
Nov. 28	27.8	26	17.8	26	9.8		
Dec. 1	38.0	29	26.2	29	21.1		
Dec. 9	28.7	7	15.7				
Dec. 12	29.8	10	14.5	10	7.5		
Dec. 15	41.3	13	32.1	13	14.8		
1879.							
Jan. 15	24.6	12	7.3				
Jan. 18	26.5	15	7.2	15	21.0		
Jan. 21	33.3	18	14.2	18	13.2		
Jan. 27	32.3	24	21.0				
Jan. 30	33.2	27	17.5	27	9.2		
Feb. 2	40.2	30	28.2	30	13.0		
Mar. 9	29.2	7	20.7				
Mar. 12	36.3	10	25.5	10	8.7		
Mar. 15	38.0	13	29.7	13	8.6		
Mar. 24	30.3	21	13.3				
Mar. 27	36.1	24	21.0	24	8.3		
Mar. 30	39.2	27	20.5	27	7.8		

Cincinnati.		Marietta.		Charleston, W. Va.		Louisa, Ky.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1879.							
Dec. 21	17.6	18	9.5				
Dec. 24	22.1	21	7.0	21	6.0		
Dec. 27	42.8	24	12.0	24	9.8		
1880.							
Jan. 3	24.7	31	11.3				
Jan. 6	38.3	3	26.1	3	5.7		
Jan. 9	42.0	6	27.7	6	5.7		
Feb. 11	14.0	8	7.0				
Feb. 14	37.8	11	6.5	11	4.9		
Feb. 17	53.2	14	25.2	14	26.2		
Mar. 5	27.7	2	12.5				
Mar. 8	34.3	5	15.5	5	5.8		
Mar. 11	45.1	8	21.8	8	8.8		
Apr. 23	14.7	20	6.4				
Apr. 26	30.0	23	6.2	23	5.1		
Apr. 29	45.4	26	18.5	26	19.8		
June 15	16.7	12	4.1				
June 18	18.8	15	7.0	15	5.4		
June 21	24.8	18	18.0	18	8.4		
Dec. 2	10.5	30	3.8				
Dec. 5	30.2	2	7.4	2	12.9		
Dec. 8	37.0	5	20.5	5	7.4		
1881.							
Jan. 18	23.3	15	11.0				
Jan. 21	28.5	18	9.8	18	6.8		
Jan. 24	35.8	21	14.6	21	10.8		
Feb. 10	34.8	7	6.2				
Feb. 11	32.8						
Feb. 13	43.3	10	20.5	10	6.3		
Feb. 16	50.5	13	39.5	13	16.8		
Apr. 11	35.6	8	8.0				
Apr. 14	38.7	11	14.6	11	11.9		
Apr. 17	42.6	14	24.0	14	14.0		
June 9	10.7	6	5.6				
June 12	17.9	9	11.0	9	5.7		
June 15	35.0	12	34.6	12	5.1		
Dec. 12	12.2	9	7.3				
Dec. 15	17.8	12	6.5	12	4.4		
Dec. 18	33.7	15	12.2	15	11.9		
Dec. 26	34.8	23	14.5				
Dec. 29	39.3	26	21.7	26	8.7		
1882.							
Jan. 1	41.1	30	26.3	29	14.0		
Jan. 10	37.6	8	13.8				
Jan. 13	46.8	11	21.5	11	13.1		
Jan. 16	48.5	14	26.3	14	14.9		

Cincinnati.		Marietta.		Charleston, W. Va.		Louisa, Ky.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1882.							
Feb. 15	42.2	11	21.5				
Feb. 18	51.5	14	21.8	14	11.8		
Feb. 21	58.6	17	25.5	17	20.8		
Mar. 4	24.6	1	12.3				
Mar. 7	31.2	4	14.8	5	7.5		
Mar. 10	39.4	7	15.5	9	9.1		
Mar. 18	26.7	15	14.8				
Mar. 21	39.6	18	11.2	18	6.5		
Mar. 24	46.9	21	25.0	21	18.5		
Apr. 24	13.6	21	6.5				
Apr. 27	17.5	24	8.9	24	4.9		
Apr. 30	24.2	27	14.4	27	7.4		
May 10	30.7	8	9.8				
May 13	36.8	11	15.5	11	9.7		
May 16	46.4	14	26.0	14	18.8		
June 9	26.4	6	17.2				
June 12	*20.0	9	13.2	9	5.0		
June 15	35.0	12	10.8	12	4.2		
1883.							
Jan. 18	15.2	15	4.3				
Jan. 21	23.3	18	6.8	18	7.5		
Jan. 24	31.3	21	16.2	21	12.0		
Feb. 9	56.3	6	34.5				
Feb. 12	62.9	9	43.7	9	20.4		
Feb. 15	66.3	12	30.0	12	25.6		
Apr. 3	43.3						
Apr. 6	37.5			3	16.0		
Apr. 9	46.5			6	10.9		
May 23	22.5						
May 26	23.2			23	4.6		
May 29	27.3			26	4.9		
Dec. 22	11.2						
Dec. 25	35.6			22	5.8	22	1.9
Dec. 28	49.5			25	17.6	25	26.0
1884.							
Feb. 5	53.5						
Feb. 8	62.9	5	29.9				
Feb. 11	66.8	8	49.5	8	21.8	8	29.0
Feb. 14	71.1	11	46.1	11	28.4	11	45.2
Mar. 11	40.9	9	9.0				
Mar. 14	48.3	12	24.5	12	12.3	12	28.0
Mar. 17	49.6	15	32.8	15	11.1	15	20.3
1885.							
Jan. 1	15.3	31	7.8				
Jan. 4	17.3	1	11.2	31	3.6	31	3.0
Jan. 7	25.3	3	16.8	3	4.4	3	3.2

* Falling.

Cincinnati.		Marietta.		Charleston, W. Va.		Louisa, Ky.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1885.							
Jan. 14	24.3	12	12.7				
Jan. 17	41.1	15	14.8	15	8.4	15	5.0
Jan. 20	46.0	18	30.5	18	17.4	18	20.0
Feb. 6	13.8	3	9.0				
Feb. 9	19.9	6	10.0	6	5.8	6	4.4
Feb. 12	28.6	9	13.0	9	6.0	9	7.0
Mar. 1	16.7	27	6.5				
Mar. 4	23.6	2	9.2	2	9.6	2	10.5
Mar. 7	24.5	5	14.0	5	7.4	5	7.0
Apr. 2	10.8	30	7.8				
Apr. 5	25.5	2	12.8	2	6.8	2	4.5
Apr. 8	33.0	5	23.2	5	9.5	5	8.5
Apr. 15	26.5	13	16.0				
Apr. 18	31.7	16	14.7	16	6.4	16	4.6
Apr. 21	36.8	19	20.1	19	12.1	19	26.0
Dec. 11	13.5	8	7.0				
Dec. 14	20.6	11	10.1	11	8.4	11	4.6
Dec. 17	30.1	14	16.5	14	10.6	14	10.5
1886.							
Jan. 3	14.2	1	8.0				
Jan. 6	26.8	4	13.8	4	6.9	4	7.5
Jan. 9	39.1	7	28.7	7	16.4	7	14.2
Feb. 12	21.7	9	6.2				
Feb. 15	33.5	12	8.0	12	11.9	12	20.0
Feb. 18	40.5	15	29.0	15	13.0	15	14.0
Mar. 20	14.4	18	8.0				
Mar. 23	23.5	21	11.3	21	6.5	21	10.5
Mar. 26	31.0	24	20.4	24	8.9	24	13.8
Apr. 3	52.8	31	23.2				
Apr. 6	54.2	3	30.1	3	20.0	3	25.6
Apr. 9	55.8	6	24.1	6	30.8	6	38.5
May 8	15.8	5	5.5				
May 11	31.6	8	6.3	8	18.5	8	24.5
May 14	36.8	11	13.3	11	9.7	11	12.8
Nov. 18	11.2	15	5.4				
Nov. 21	15.3	18	8.8	18	5.0	18	3.1
Nov. 24	29.7	21	17.2	21	6.7	21	3.7
Dec. 14	10.2	11	5.5				
Dec. 17	18.0	14	7.1	14	7.0	14	7.0
Dec. 20	24.7	17	13.6	17	7.3	17	8.0
1888.							
Jan. 7	17.0	4	11.5				
Jan. 10	26.5	7	13.0	7	5.0	8	7.3
Jan. 13	34.2	10	27.9	10	7.3	10	3.0
Feb. 24	17.5	22	9.1				
Feb. 27	22.9	25	12.7	24	6.1	25	5.0
Mar. 1	24.1	28	17.0	27	6.4	27	5.5

Cincinnati.		Marietta.		Charleston, W. Va.		Louisa, Ky.	
Date.	Stage	Date.	Stage	Date.	Stage.	Date.	Stage.
1888.							
Apr. 6	26.3	2	17.5				
Apr. 9	22.4	5	13.3	6	5.6	6	5.0
Apr. 12	32.9	9	19.9	11	5.9	12	5.8
July 9	9.1	7	5.8				
July 12	25.8	10	20.3	6	4.9		
July 15	31.4	13	24.0	11	6.5		
Aug. 20	6.2	18	4.0				
Aug. 23	19.2	21	7.8	21	4.5		
Aug. 26	32.0	24	28.5	24	5.2		
Oct. 23	28.0	21	14.3				
Oct. 26	28.3	24	15.0	24	7.7		
Oct. 29	33.0	27	12.2	27	18.6		
Nov. 3	27.8	31	11.9				
Nov. 6	23.0	4	9.0	7	4.9		
Nov. 9	33.5	7	10.5	9	4.8		
1889.							
Jan. 3	22.3						
Jan. 6	24.4	3	10.4	3	6.9	4	6.6
Jan. 9	31.5	6	12.7	6	6.9	6	8.9
Jan. 25	22.4						
Jan. 28	27.0	25	7.9	25	5.7	26	9.1
Jan. 31	34.5	28	13.5	28	14.5	28	14.9
Feb. 16	14.4						
Feb. 19	28.0	16	9.6	16	5.0	17	5.8
Feb. 22	38.1	19	13.0	19	22.3	19	21.6
May 30	15.1						
June 2	26.0	30	6.0	30	6.4	31	6.4
June 5	33.3	2	12.5	2	23.9	2	8.5
June 14	17.4						
June 17	25.8	14	9.0	14	10.3	15	17.0
June 20	28.9	17	12.4	17	11.3	17	15.0
Nov. 9	18.7						
Nov. 12	22.0	9	8.9	9	6.5	10	13.5
Nov. 15	30.2	12	15.6	12	9.5	12	11.6
Nov. 21	24.7						
Nov. 24	29.2	21	16.3	21	9.1	21	7.6
Nov. 27	33.6	24	17.9	24	10.8	24	10.8
Dec. 10	17.9						
Dec. 13	23.0	10	9.5	10	5.6	11	4.8
Dec. 16	28.4	13	19.1	13	6.4	13	6.7
1890.							
Jan. 6	19.2	3	8.9				
Jan. 9	33.8	6	9.9	6	5.5	7	5.8
Jan. 12	40.2	9	26.3	9	11.3	9	11.5
Jan. 15	34.5	12	20.2				
Jan. 18	40.3	15	16.3	15	5.6	16	9.4
Jan. 21	43.8	18	29.9	18	7.4	18	13.5

Cincinnati.		Marietta.		Charleston, W. Va.		Louisa, Ky.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1890.							
Jan. 30	24.3	27	12.0				
Feb. 2	23.2	30	11.0	30	6.4	31	6.6
Feb. 5	35.0	2	12.0	2	14.0	2	10.7
Feb. 5	35.0	2	12.0				
Feb. 8	36.7	5	13.7	5	11.1	6	13.0
Feb. 11	43.2	8	22.4	8	8.2	8	16.9
Feb. 16	30.9	12	16.9				
Feb. 19	35.4	15	16.1	16	12.2	17	11.5
Feb. 22	43.2	18	25.8	19	8.8	19	10.0
Feb. 23	43.0	20	22.8				
Feb. 26	49.4	23	26.2	23	8.6	24	13.7
Mar. 1	56.8	26	21.7	26	25.6	26	45.0
Mar. 20	46.5	17	27.4				
Mar. 23	52.0	20	19.0	20	16.3	21	24.7
Mar. 26	59.1	23	31.0	23	30.9	23	40.0
May 20	29.6	17	17.3				
May 23	39.4	20	14.3	20	10.1	21	26.3
May 26	40.8	23	26.2	23	9.9	23	15.3
Aug. 24	10.6	21	4.2				
Aug. 27	13.8	24	5.7	24	5.5	25	3.1
Aug. 30	20.8	27	12.4	27	5.6	27	4.8
Sept. 12	20.6	9	8.0				
Sept. 15	28.5	12	14.5	12	6.4	13	5.7
Sept. 18	35.2	15	27.2	15	6.2	15	3.9
1891.							
Dec. 31*	25.9	1	11.7	31*	6.0	31*	10.2
Jan. 3	38.5	4	34.5	3	26.9	2	26.8†
Jan. 6	48.7					3	26.2
			†		†		
Feb. 19	41.5	18	34.5	19	8.4	19	12.9
Feb. 22	53.4	21	44.6	20	8.0	22	28.0
Feb. 25	57.3		†	22	14.7	23	32.5†
				23	18.5		
			†		†		
Mar. 6	33.0			6	13.0	5	28.5
Mar. 9	35.4	9	13.9	9	20.0	6	20.3
Mar. 12	43.3	12	20.8	10	22.0	9	25.4
			†		†		

* 1890. † Crest.

These stages of water observed at Parkersburg, Charleston, and Louisa are available for devising a method of computing the rise of river at Cincinnati.

For any particular rise in the water at any of these places the effect of the rise may be considered to be greater at Cincinnati the less the stage of water at Cincinnati, and the greater the stage at any of the other places. On this basis a rule is derived for computing the rise at Cincinnati in terms of those at the other places.

The rise at Cincinnati from three days before a crest until the day of the crest multiplied by the stage three days before the crest was placed equal to an unknown factor multiplied by the sum of the three to six day rise or fall preceding the Cincinnati crest at Parkersburg, Charleston, and Louisa, each multiplied by the mean stages at those places for the three days. By solving the equations from seven cases since 1884, where the Cincinnati stage was greater than 40 feet, this factor for the rise is found to be 0.34 for a mean stage of 50 feet. From nineteen cases where the Cincinnati stage was between 25 and 40 feet, the factor is found to be 0.75 for a mean stage of 30 feet. Accordingly the following rule is adopted for computing the crest of the flood wave at Cincinnati from the stage at Cincinnati three days before crest and the stages and changes in the rivers at Parkersburg, W. Va., Charleston, W. Va., and Louisa, Ky., which occur three days and six days before the Cincinnati crest.

At any time when the river at Cincinnati is at a rising stage and has been rising for at least three days, then the rise in the next three days will be as follows:

The rise or fall in feet at Parkersburg, Charleston, and Louisa for the three days preceding the Cincinnati rise, multiplied by the mean stages at the respective places for the three days, are added together.

This sum is multiplied by the following factor, dependent on the stage of river at Cincinnati, and divided by the stage of water at Cincinnati.

Stage.	Factor.	Stage.	Factor.	Stage.	Factor.	Stage.	Factor.
25	0.95	32	0.67	39	0.44	45	0.37
26	0.97	33	0.63	40	0.42	46	0.36
27	0.87	34	0.59	41	0.41	47	0.35
28	0.83	35	0.55	42	0.42	48	0.34
29	0.79	36	0.51	43	0.39	49	0.34
30	0.75	37	0.48	44	0.38	50	0.34
31	0.71	38	0.46	....	....	....	....

In the following tables are shown the observed rises at Cincinnati and the rises computed by the rule.

Cincinnati.				Cincinnati.			
Date.	Gauge reading.	Rise in three days.	Computed rise.	Date.	Gauge reading.	Rise in three days.	Computed rise.
1885.				1890.			
Apr. 5	25.5	7.5	8.2	Jan. 9	33.8	6.4	6.8
Apr. 18	31.7	5.1	9.7	Feb. 2	23.2	11.8	5.2
1886.				Feb. 8	36.7	6.5	2.4
Jan. 6	26.8	12.3	16.8	Feb. 19	35.4	7.8	2.5
Feb. 15	33.5	7.0	5.1	May 23	39.4	1.4	0.0
Mar. 23	23.5	7.5	8.1	Sept. 15	28.5	6.7	7.0
May 11	31.6	5.2	−5.8	1884.			
1888.				Feb. 11	66.8	4.3	3.0
Jan. 10	26.5	7.7	10.3	Mar. 14	48.3	1.3	0.7
1889.				1885.			
Jan. 6	24.4	7.1	1.5	Jan. 17	41.1	4.9	6.7
Jan. 28	27.0	7.5	7.1	1886.			
Feb. 19	28.0	10.1	14.8	Apr. 6	54.2	1.6	3.3
June 2	26.0	7.3	11.8	1890.			
June 17	25.8	3.1	0.6	Jan. 18	40.3	3.5	3.5
Nov. 24	29.2	4.4	2.0	Feb. 26	49.4	7.4	7.7
Dec. 13	23.0	5.4	6.2	Mar. 23	52.0	7.1	7.4

The great floods are only produced when there is a conjunction of circumstances exceptionally favorable for flood production, such as successive floods in the tributaries added together, long continued rainfall, frozen ground, small evaporation, etc.

Floods occur only in the early part of the year. The great floods are to some extent associated with the melting of the accumulated snows of the winter.

It makes a difference in a flood whether the ground is previously frozen to some depth before snow has fallen.

The rate of rainfall and the absolute quantity of water that falls are the chief determining causes of floods.

The character of the ground is a matter to be considered, whether saturated by a series of preparatory rains, or whether frozen hard so that no water can be absorbed. In the case of frozen ground 72 per cent of the rainfall or melted snow runs off.

Some idea of a coming stage of water can be formed from gauge readings made at Cincinnati alone. The average duration of important rises is about six days. The daily rate of rise increases from the sixth to the third day before a crest and diminishes from the third day to the day of crest.

The average of successive daily rises at Cincinnati for six days preceding crests are as follows:

	Feet.
6th to 5th	2.2
5th to 4th	3.2
4th to 3d	3.8
3d to 2d	4.0
2d to 1st	2.8
1st to crest	1.3

MEAN STAGES.

Parkersburg.	Charleston.	Louisa.	Cincinnati, three days after.
Feet.	*Feet.*	*Feet.*	*Feet.*
24.9	12	15	39.7
24.9	27	42	55.5
33.3	9		42.6
33.1	30	40	57.2
35.2	15	20	48.2
33.1	30	40	57.2
44.7	8	21	57.3
46.6	27	45	68.7
55.0	21	29	71.1

The corresponding wave crests at Catlettsburg and Cincinnati, one day later in the case of medium stages and in two or three days for stages above 50 feet, are as follows:

Catlettsburg.	Cincinnati, two or three days after.	Catlettsburg.	Cincinnati, two or three days after.
Feet.	*Feet.*	*Feet.*	*Feet.*
32	33.4	44	47.2
33	34.5	45	48.5
34	35.5		
35	36.6	46	50.0
		47	51.5 ±1.1
36	37.7	48	52.8
37	38.8	49	53.7
38	40.0	50	54.5
39	41.3		
40	42.4	51	55.4
		52	56.2
41	43.5	53	57.1
42	44.6	54	57.8
43	45.8	55	58.5

LOUISVILLE, KY.

The danger line at Louisville is at the 24-foot stage.

The highest water observed was 46.6 feet, February 16, 1884.

The distance to Cincinnati is 132.5 miles.

The difference in level of the zeros of the gauges at Cincinnati and Louisville is 20.7 feet.

The corresponding crest-wave stages at Cincinnati and Louisville one day later are given in the table below.

Cincinnati.	Louisville, one day after.		Cincinnati.	Louisville, one day after.		Cincinnati.	Louisville, one day after.	
13	7.2		33	13.0		53	29.2	
14	7.2	±0.5	34	13.3		54	30.6	
15	7.4		35	13.8		55	31.5	±0.7
16	7.5		36	14.4		56	32.8	
17	7.9		37	15.1		57	34.0	
18	8.2		38	15.6		58	35.3	
19	8.4		39	16.3		59	36.9	
20	8.7	±0.3	40	16.9	±1.1	60	38.2	
21	9.0		41	17.5		61	39.4	
22	9.3		42	18.1		62	40.5	
23	9.6		43	18.7		63	41.5	
24	9.7		44	19.4		64	42.5	
25	10.2		45	20.4		65	43.4	
26	10.4		46	21.5		66	44.0	
27	10.7		47	22.7		67	44.8	
28	11.2		48	23.7		68	45.4	
29	11.5		49	25.0		69	46.0	
30	11.8	±1.0	50	26.0	±1.4	70	46.4	
31	12.3		51	27.0		71	46.6	
32	12.6		52	28.2		72		

Considerable volumes of water are added to the Ohio between Cincinnati and Louisville by the Licking River at Cincinnati, by the Little Miami, and by the Kentucky River.

EVANSVILLE, IND.

The danger line at Evansville is at the 30-foot stage.

The distance to Cincinnati is 316.5 miles.

The difference in level of the zeros of gauges at Cincinnati and Evansville is 105 feet.

The corresponding wave-crest stages at Cincinnati and Evansville three days later are as follows:

Cincinnati.	Evansville, two days after.	Cincinnati.	Evansville, two days after.	Cincinnati.	Evansville, two days after.
10	5.2	32	25.8	54	44.0
11	6.2 ±0.8	33	26.7	55	44.6 ∓1.7
12	7.2	34	27.6	56	45.1
13	8.1	35	28.6 ±1.7	57	45.6
14	9.0	36	29.4	58	46.1
15	10.0 ∓1.4	37	30.2	59	46.6
16	10.9	38	31.0	60	47.0
17	11.8	39	31.9	61	47.2
18	12.7	40	32.8 ±1.7	62	47.4
19	13.6	41	33.6	63	47.6
20	14.4 ∓1.5	42	34.4	64	47.8
21	15.4	43	35.3	65	48.0
22	16.4	44	36.2	66	48.0
23	17.4	45	37.0 ±1.0	67	48.1
24	18.4	46	37.8	68	48.1
25	19.4 ±1.4	47	38.7	69	48.1
26	20.3	48	39.6	70	48.1
27	21.2	49	40.4	71	48.2
28	22.1	50	41.2 ±1.2	72	
29	23.0	51	41.9	73	
30	24.0 ±1.6	52	42.6		
31	24.9	53	43.3		

The principal tributaries coming into the Ohio between Cincinnati and Evansville are the Kentucky and the Green rivers. The latter drains 9,600 square miles.

MOUNT VERNON, IND.

The danger line at Mount Vernon, Ind., is at 35 feet.
The highest water, 51.7 feet, occurred February 22, 1884.
The distance from Mount Vernon to Evansville is 36.5 miles.
The corresponding crest-wave stages at Cincinnati and Mount Vernon three to four days after are given below.

Cincinnati.	Mount Vernon, three or four days after.	Cincinnati.	Mount Vernon, three or four days after.	Cincinnati.	Mount Vernon, three or four days after.
25	17.7 ±1.8	37	30.7	49	42.8
26	18.5	38	32.3	50	43.3
27	19.6	39	34.2		
28	20.5	40	35.6	51	43.6
29	21.6			52	43.8
30	22.5	41	37.3	53	44.2
		42	38.7	54	44.6
31	23.4	43	39.6	55	44.9
32	24.4	44	40.2		
33	25.4	45	40.7	56	45.3
34	26.2			57	45.6
35	27.7 ±2.1	46	41.3	58	45.8
		47	41.8	59	46.2
36	29.3	48	42.4	60	46.4

CARTHAGE, TENN.

The danger line at Carthage, Tenn., is at 30 feet. The water sometimes rises as high as 60 feet.
The distance from Burnside, Ky., to Carthage, Tenn., is 177 miles.
The corresponding wave crests at Burnside and Carthage two days later are as follows:

Burnside.	Carthage.	Burnside.	Carthage.	Burnside.	Carthage. Two days after.
4	2.5 ±1.6	26	22.6	47	36.4
5	3.9	27	23.6	48	37.0
6	5.5	28	24.7	49	38.0
7	6.9	29	25.3	50	39.1 ±0.5
8	8.0	30	25.8		
9	8.9			51	40.2
10	9.9 ±2.2	31	26.3	52	41.4
		32	26.8	53	42.3
11	10.7	33	27.3	54	43.2
12	11.6	34	27.8	55	44.0
13	12.5	35	28.3 ±2.2		
14	13.2			56	45.0
15	14.0 ±2.4	36	28.9	57	45.8
		37	29.4	58	46.6
16	14.8	38	30.0	59	47.5
17	15.6	39	30.9	60	48.4
18	16.3	40	31.5 ±2.3		
19	16.9			61	49.1
20	17.6 ±1.6	41	32.3	62	50.1
		42	33.0	63	
21	18.4	43	33.8	64	
22	19.2	44	34.2	65	
23	19.9	45	35.0 ±0.2		
24	20.7				
25	21.6 ±2.2	46	35.7		

The difference in level of gauge zeros at Burnside and Carthage is 146 feet.

NASHVILLE, TENN.

The danger line at Nashville is at 40 feet. The high water of 1847 was 54.7 feet.

The distance from Nashville to Burnside is 259 miles.

The difference in level of gauge zeros at Burnside and Nashville is 223 feet.

The corresponding wave-crest water stages at Burnside and Nashville three days later are as follows:

Burnside.	Nashville, three days after.	Burnside.	Nashville, three days after.	Burnside.	Nashville, three days after.
5	5.2 ±1.8	26	26.0	47	43.3
		27	27.3	48	43.7
6	6.5	28	28.8	49	44.2
7	7.8	29	30.0	50	44.6
8	9.1	30	31.4 ±0.5		
9	10.2			51	45.0
10	11.3 ±1.7	31	32.6	52	45.3
		32	33.7	53	45.8
11	12.3	33	35.2	54	46.3
12	13.4	34	36.0	55	46.5
13	14.5	35	36.6		
14	15.5			56	46.9
15	16.5 ±2.3	36	37.3	57	47.3
		37	37.9	58	47.7
16	17.8	38	38.5	59	48.2
17	18.9	39	39.2	60	48.6
18	19.6	40	39.9		
19	20.0			61	48.9
20	20.5 ±1.4	41	40.5	62	49.4
		42	41.2	63	
21	20.9	43	41.8	64	
22	21.4	44	42.2	65	
23	22.2	45	42.6		
24	23.4				
25	24.8	46	42.9		

The distance from Carthage to Nashville is 82 miles.
The difference in level of gauge zeros at Nashville and Carthage is 77 feet.
The corresponding wave-crest water stages at Carthage and Nashville one or two days later are as follows:

Carthage.	Nashville, one or two days after.	Carthage.	Nashville, one or two days after.	Carthage.	Nashville, one or two days after.
5	6.6 ±0.8	22	22.7	40	41.0 ∓0.8
		23	24.1		
6	7.9	24	25.8	41	41.9
7	9.2	25	27.3 ±1.8	42	42.8
8	10.6			43	43.5
9	11.9	26	28.9	44	44.1
10	13.1 ±1.1	27	30.5	45	44.9
		28	31.9		
11	14.5	29	32.6	46	45.5
12	15.8	30	33.4	47	46.3
13	16.6			48	46.9
14	17.1	31	34.0	49	47.6
15	17.9 ±1.4	32	34.6	50	48.3
		33	35.4		
16	18.6	34	36.2	51	48.9
17	19.3	35	36.9 ±1.8	52	49.7
18	20.0			53	
19	20.5	36	37.7	54	
20	21.0 ∓2.3	37	38.3	55	
		38	39.2		
21	21.8	39	40.1		

EDDYVILLE, KY.

The danger line at Eddyville is at 31 feet. The highest water, 60.4 feet, occurred in 1882.
The distance to Nashville is 135 miles.
The corresponding wave-crest water stages at Nashville and Eddyville two days later are as follows:

Nashville.	Eddyville, two days after.	Nashville.	Eddyville, two days after.	Nashville.	Eddyville, two days after.
10	10.0	25	29.4	40	49.8
11	11.0	26	30.7	41	50.8
12	12.5	27	32.0	42	51.4
13	14.0	28	33.6	43	51.8
14	15.3	29	35.0	44	52.4
15	16.7	30	36.7 ±1.8	45	53.0
16	18.0	31	38.2	46	53.4
17	19.2	32	39.6	47	53.9
18	20.4	33	41.0	48	54.5 ±1.8
19	21.7	34	42.6	49	55.0
20	23.0	35	44.2	50	55.5
21	24.3	36	45.6	51	56.0
22	25.7	37	46.7	52	
23	27.0	38	47.7		
24	28.3	39	48.7		

CHATTANOOGA, TENN.

The danger line at Chattanooga is at 33 feet. The highest water, 58.05 feet, occurred March 11, 1867.

The distance to Clinton is 148 miles.

The difference in level of gauge zeros at Chattanooga and Clinton is 151.7 feet. The difference in level of gauge zeros at Chattanooga and Knoxville is 180.4 feet.

The corresponding wave-crest water stages at Clinton and Chattanooga two days later are as follows:

Clinton.	Chattanooga, two days after.	Clinton.	Chattanooga, two days after.	Clinton.	Chattanooga, two days after.
5	6.2	19	20.4	33	38.5
		20	21.6	34	40.5
6	7.3			35	41.5
7	8.4	21	23.0		
8	9.5	22	24.5	36	43.0
9	10.7	23	25.9	37	44.0
10	12.0	24	26.5	38	45.1
		25	27.3	39	46.2
11	13.1			40	47.3
12	14.7	26	28.1		
13	15.9	27	29.5	41	48.3
14	16.3	28	31.0	42	49.4
15	17.0	29	32.6	43	50.2
		30	34.0	44	51.2
16	17.5			45	52.2
17	18.0	31	35.5		
18	19.0	32	36.9		

The stage of water at Chattanooga is mainly the result of the stage of water at Clinton and Knoxville about two days previous. Considerable volumes of water are added to the Tennessee between the two places by the Hiawassee River, which enters the Tennessee 35 miles above Chattanooga. There is a gauge on the Hiawassee at Charleston, Tenn.

The most advantageous way of finding a coming rise at Chattanooga from rises at Clinton and Knoxville is as follows:

Rule.—The rise at Chattanooga in the two days succeeding a crest at Clinton or Knoxville is equal to the preceding two-day rises at Clinton and Knoxville multiplied by the mean stages at the places on the two days, the sum divided by the stage at Chattanooga on the day of the Clinton crest and multiplied by the following factor dependent on the Chattanooga stage.

Chattanooga stage.	Factor.	Chattanooga stage.	Factor.	Chattanooga stage.	Factor.
12	0.87	26	0.43	40	0.245
13	0.86	27	0.41		
14	0.84	28	0.39	41	0.24
15	0.82	29	0.37	42	0.23
		30	0.35	43	0.225
16	0.80			44	0.215
17	0.78	31	0.33	45	0.21
18	0.75	32	0.31		
19	0.72	33	0.30	46	0.20
20	0.67	34	0.29	47	0.19
		35	0.285	48	0.19
21	0.61			49	0.18
22	0.56	36	0.28	50	0.18
23	0.51	37	0.27		
24	0.47	38	0.26		
25	0.45	39	0.255		

The probable error of a computed stage by the above rule is ± 2.1 feet.
The following are some of the rises at Chattanooga and those preceding at Clinton and Knoxville:

Chattanooga.		Clinton.		Knoxville.	
Date.	Rise.	Date.	Rise.	Date.	Rise.
1885.					
Jan. 16	16.0	15	9.2	16	3.9
Jan. 17	22.5	16	13.7	17	8.3
Jan. 18	26.5	17	18.9	18	9.7
1886.					
Jan. 3	8.1	4	9.8	4	5.1
Jan. 4	18.0	5	10.7	5	11.0
Jan. 5	22.1	6	14.5	6	11.8
Jan. 22	12.9	20	10.8	20	5.6
Jan. 23	14.0	21	12.9	21	5.4
Jan. 24	15.0	22	13.5	22	6.8
Feb. 12	9.0	10	5.9	7	2.3
Feb. 13	12.6	11	6.2	8	2.2
Feb. 14	13.1	12	14.0	9	2.5
Mar. 21	8.4	20	4.6	19	1.1
Mar. 22	12.4	21	15.4	20	1.8
Mar. 23	14.5	22	19.2	21	3.9
Mar. 31	40.5				
Apr. 1	47.1	29	17.7	29	8.2
Apr. 2	51.0	30	31.5	30	13.8
Apr. 3	52.2	31	45.0	31	29.6
Dec. 15	9.0	13	5.7	12	3.9
Dec. 16	9.6	14	7.8	13	5.6
Dec. 17	11.6	15	10.9	14	8.0
Dec. 20	14.0	17	8.6	17	4.8
Dec. 21	16.0	18	10.7	18	5.2
Dec. 22	16.6	19	13.2	19	6.4
Dec. 30	10.6	25	8.7	30	4.7
Dec. 31	10.7	26	12.5	31	5.6
1887.					
Jan. 1	11.0	27	15.7	1	7.3
Jan. 24	13.0	24	14.5	23	2.7
Jan. 25	19.6	25	15.5	24	8.1
Jan. 26	21.8	26	15.8	25	13.4
Jan. 30	13.8	31	12.8	28	5.7
Jan. 31	15.3	1	12.3	29	5.7
Feb. 1	16.2	2	14.3	30	7.3
Feb. 5	19.0	2	14.3	2	5.4
Feb. 6	21.0	3	12.6	3	5.3
Feb. 7	21.8	4	17.4	4	14.3
Feb. 15	9.0	15	7.4	15	3.7
Feb. 16	12.8	16	9.0	16	4.1
Feb. 17	13.4	17	11.4	17–18	5.0

Chattanooga.		Clinton.		Knoxville.	
Date.	Rise.	Date.	Rise.	Date.	Rise.
1887.					
Feb. 20	10.6	16	9.0	16	4.1
Feb. 21	17.0	17	11.4	17	5.0
Feb. 22	19.0	18	12.2	18	5.0
Feb. 26	25.3	24	18.2	23	8.2
Feb. 27	26.8	25	25.3	24	10.8
Feb. 28	27.3	26	26.4	25	12.4
Mar. 9	16.0	7	8.1	7	5.7
Mar. 10	21.7	8	13.7	8	9.3
Mar. 11	24.0	9	20.8	9	11.8
1888.					
Jan. 1	8.0	1	8.4	1	5.3
Jan. 2	14.5	2	9.7	2	5.5
Jan. 3	14.7	3	9.9	3	5.7
Jan. 13	11.2	9	5.5	9	4.1
Jan. 14	13.2	10	10.5	10	5.0
Jan. 15	14.5	11	13.8	11	5.5
Jan. 17	14.9	16	10.8	16	6.2
Jan. 18	21.4	17	12.1	17	8.4
Jan. 19	25.7	18	16.5	18	12.6
Feb. 24	6.3	24	4.4	24	2.6
Feb. 25	9.4	25	7.8	25	3.4
Feb. 26	11.2	26	9.5	26-27	4.0
Mar. 25	7.2	24	8.5	21	3.2
Mar. 26	11.6	25	8.8	22	4.3
Mar. 27	22.6	26	12.5	23	5.5
Mar. 29	19.8	27	11.5	28	5.8
Mar. 30	24.5	28	12.4	29	10.2
Mar. 31	27.0	29	13.4	30	13.3
1889.					
Jan. 9	11.3	8	7.6	8	5.7
Jan. 10	12.2	9	7.8	9	4.6
Jan. 11	12.4	10	10.0	10	4.8
Jan. 21	11.3	21	5.9	20	3.3
Jan. 22	12.0	22	5.7	21	3.7
Jan. 23	12.3	23	7.4	22	4.0
Jan. 30	13.0	28	10.8	27	4.3
Jan. 31	14.0	29	13.0	28	5.4
Feb. 1	14.6	30	13.4	29	5.8
Feb. 16	6.6				
Feb. 17	20.0				
Feb. 18	29.6				
Feb. 19	29.2	17	13.5	17	6.5
Feb. 20	27.2	18	20.0	18	10.6
Feb. 21	29.0	19	25.8	19	15.0

Chattanooga.		Clinton.		Knoxville.	
Date.	Rise.	Date.	Rise.	Date.	Rise.
1890.					
Jan. 21	7.0	21	10.5	22	6.1
Jan. 22	9.6	22	13.8	23	7.1
Jan. 23	13.0	23	16.5	24	7.3
Feb. 8	11.5	7	10.4	8	4.2
Feb. 9	19.3	8	12.7	9	7.0
Feb. 10	20.4	9	15.8	10	7.2
Feb. 28	34.8	26	23.8	26	12.9
Mar. 1	40.2	27	31.8	27	19.0
Mar. 2	42.5	28	35.5	28	23.0
Mar. 15	9.7	15	14.7	14	4.0
Mar. 16	13.7	16	17.7	15	6.9
Mar. 17	15.1	17	17.8	16	7.2
Mar. 23	20.0	22	19.9	22	7.0
Mar. 24	25.5	23	23.5	23	14.0
Mar. 25	27.2	24	24.9	24	14.6
Dec. 27	9.4	26	11.0	26	3.6
Dec. 28	12.5	27	14.8	27	5.5
Dec. 29	12.9	28	19.8	28	6.4
1891.					
Jan. 3	9.9	2	13.8	2	4.6
Jan. 4	14.1	3	19.0	3	8.5
Jan. 5	15.5	4	19.5	4	9.1
Jan. 11	6.5	10	6.9	11	3.4
Jan. 12	8.9	11	8.0	12	3.6
Jan. 13	10.7	12	11.0	13	4.5
Jan. 22	8.2	21	6.4	22	4.0
Jan. 23	12.5	22	9.5	23	5.6
Jan. 24	15.3	23	12.0	24	5.8
Feb. 3	16.1	2	11.8	2	9.0
Feb. 4	19.8	3	14.5	3	9.4
Feb. 5	22.6	4	18.8	4	11.0
Feb. 12	34.3	10	21.8	9	5.4
Feb. 13	36.5	11	29.5	10	14.9
Feb. 14	37.5	12	29.8	11	21.9
Feb. 23	24.0	22	15.9	21	6.7
Feb. 24	27.7	23	17.7	22	15.7
Feb. 25	29.0	24	18.4	23	19.0
Mar. 9	34.5	7	18.8	8	11.7
Mar. 10	37.5	8	19.8	9	16.4
Mar. 11	38.9	9	27.2	10	16.9
Mar. 26	10.4	26	9.0	27	5.2
Mar. 27	10.5	27	11.4	28	5.1
Mar. 28	14.1	28	11.7	29	6.8
Apr. 1	15.4	31	10.4	31	6.0
Apr. 2	16.3	1	12.6	1	7.4
Apr. 3	16.3	2	14.0	2	8.9

DECATUR, ALA.

The danger-line at Decatur is at 21 feet. The highest water, 28.7 feet, occurred in 1867.

The difference in level of the zeros of gauges at Decatur and Chattanooga is 92.9 feet.

The distance from Decatur to Chattanooga is 160 miles.

The corresponding wave-crest water stages at Chattanooga and Decatur two days later are as follows:

Chattanooga.	Decatur two days after.	Chattanooga.	Decatur two days after.	Chattanooga.	Decatur two days after.
15	12.2 ±0.7	29	18.2	42	23.5
16	12.6	30	18.5 ±0.8	43	23.9
17	13.0			44	24.3
18	13.4	31	18.7	45	24.6
19	13.9	32	19.2		
20	14.4 ±0.9	33	19.6	46	24.9
		34	19.9	47	25.3
21	14.7	35	20.4	48	25.5
22	15.3			49	25.7
23	15.6	36	20.9	50	26.0
24	16.0	37	21.3		
25	16.5	38	21.7	51	26.4
		39	22.2	52	26.7
26	16.9	40	22.7	53	
27	17.3			54	
28	17.7	41	23.2	55	

FLORENCE, ALA.

The danger-line at Florence, Ala., is at 30.2 feet. The highest water, 31.1 feet, occurred in 1867.

The corresponding wave-crest water stages at Chattanooga and at Florence three days later are as follows:

Chattanooga.	Florence, three days after.	Chattanooga.	Florence, three days after.	Chattanooga.	Florence, three days after.
16	11.7 ±0.8	29	18.9	41	27.2
17	12.3	30	19.6 ±2.3	42	27.4
18	12.7			43	27.5
19	13.3	31	20.2	44	27.6
20	13.8 ±1.3	32	20.6	45	27.6
		33	21.3		
21	14.4	34	21.7	46	27.7
22	15.1	35	22.4	47	27.7
23	15.5			48	27.8
24	16.1			49	27.8
25	16.6	36	23.3	50	27.8
		37	24.0		
26	17.3	38	24.7	51	27.9
27	17.8	39	25.5	52	28.0
28	18.4	40	26.4	53	

JOHNSONVILLE, TENN.

The danger-line at Johnsonville, Tenn., is at 21 feet.

The difference in level of the zeros of gauges at Johnsonville and Chattanooga is 311.8 feet.

The distance from Johnsonville to Chattanooga is 360 miles.

The corresponding wave-crest water stages at Chattanooga and Johnsonville five to six days later are as follows:

Chattanooga.	Johnsonville, five or six days after.	Chattanooga.	Johnsonville, five or six days after.	Chattanooga.	Johnsonville, five or six days after
32	32.5	40	37.1	47	40.5
33	32.8	41	38.2	48	40.7
34	33.3	42	39.0	49	40.7
35	33.6	43	39.3	50	41.4
36	34.0	44	39.6	51	41.6
37	34.4	45	39.9	52	41.8
38	35.0	46	40.3	53	
39	36.2				

Considerable quantities of water are added to the Tennessee just above Johnsonville by the Duck River. There is a gauge on this river at Columbia.

The following table gives the most important rises at Chattanooga and the subsequent rises at Johnsonville:

Chattanooga.		Johnsonville.	
Date.	Rise.	Date.	Rise.
1875.		1876.	
Dec. 31	34.2	Jan. 7	28.9
1876.			
Jan. 26	15.7	Jan. 26	17.6
Feb. 17	21.9	Feb. 21	20.3
Mar. 18	21.1	Mar. 22	23.0
Mar. 27	17.2	Apr. 5	25.8
Apr. 16	13.4	Apr. 21	13.9
June 20	23.4	June 24	17.5
1877.		1877.	
Jan. 23	27.0	Jan. 24	24.7
1879.		1879.	
Dec. 16	17.9	Dec. 20	27.5
Dec. 26	21.9	Dec. 30	27.7
1880.		1880.	
Feb. 16	26.8	Feb. 16	24.9
Mar. 13	28.7	Mar. 22	37.7
Mar. 18	38.3	Mar. 22	37.7
1882.		1882.	
Jan. 14	30.6	Jan. 20	36.5
Jan. 20	40.1	Jan. 26	42.1
		Jan. 31	43.8
Jan. 31	30.3	Feb. 7	40.7
Mar. 3	22.0	Mar. 9	29.4
1883.		1883.	
Jan. 23	38.2	Feb. 2	29.0
Apr. 3	26.2	Apr. 9	21.6
Apr. 14	18.7	Apr. 20	25.9
1884.		1884.	
Feb. 4	25.5	Feb. 10	37.5
Feb. 11	36.8	Feb. 17	40.2
Feb. 20	27.0	Feb. 28	44.3
Mar. 10	42.8	Mar. 16	37.8
Mar. 23	27.6	Mar. 29	41.0
1885.		1885.	
Jan. 18	26.5	Jan. 23	30.0
Apr. 21	15.5	Apr. 27	15.4
June 1	18.6	June 3	13.8
Nov. 1	16.2	Nov. 5	13.0
Nov. 9	30.4	Nov. 15	23.0
Dec. 16	21.4	Dec. 21	18.8

Chattanooga.		Johnsonville.	
Date.	Rise.	Date.	Rise.
1886.		1886.	
Jan. 5	22.1	Jan. 10	25.1
Apr. 3	52.2	Apr. 9	37.6
		Apr. 15	42.1
June 23	16.0	June 26	17.4
Dec. 22	16.6	Dec. 24	14.5
1887.		1887.	
Jan. 26	21.8	Feb. 1	27 8
Feb. 28	27.3	Feb. 28	31.4
		Mar. 7	30.5
Apr. 27	21.2	May 2	14.9
1888.		1888.	
Jan. 19	25.7	Jan. 24	24.8
Mar. 27	22.6	Apr. 1	33.3
Mar. 31	27.0	Apr. 1	33.3
Apr. 12	22.4	Apr. 16	22.6
Oct. 28	20.0	Nov. 1	15.7
Nov. 12	21.0	Nov. 16	19.8
1889.		1889.	
Feb. 1	14.6	Feb. 1	16.9
Feb. 18	29.6	Feb. 25	29.2
1890.		1890.	
Jan. 23	13.0	Jan. 23	21.6
Feb. 10	20.4	Feb. 11	30.2
Mar. 2	42.5	Mar. 8	37.7
Mar. 25	27.2	Apr. 1	28.0
Apr. 20	20.4	Apr. 25	18.0
May 22	11.0	May 28	14.1
Dec. 29	12.9	Jan. 3	14.5
1891.		1891.	
Jan. 5	15.5	Jan. 9	15.0
Jan. 13	10.7	Jan. 16	14.1
Jan. 24	15.3	Jan. 29	20.0
Feb. 14	37.5	Feb. 13	33.0
Feb. 25	29.0	Feb. 23	36.1
Mar. 11	38.9	Mar. 12	38.2
Mar. 28	14.1	Apr. 3	27.0
Apr. 2	16.3	Apr. 13	19.2
Apr. 15	12.2	Apr. 28	12.2

CAIRO, ILL.

The danger-line at Cairo is at 40 feet.

The highest water, 52.2 feet, occurred February 27, 1883.

The water that passes Cairo drains from 212,000 square miles in the Ohio Valley, and from 545,000 and 172,000 square miles additional in the Missouri and Upper Mississippi Valleys.

There is available for predicting the river stages at Cairo the stages observed at St. Louis, 171 miles above on the Mississippi; at Cincinnati, 498.5 miles above, on the Ohio; at Nashville, 215 miles above, on the Cumberland, and at Chattanooga, 495 miles above, on the Tennessee.

Besides the water passing these places there is water passing Cairo which drains from 108,000 square miles of drainage area in addition below the places. In this area some idea can be formed of what quantity of water is likely to come from it by the reading of the gauges at Frankfort, on the Kentucky River. The Wabash, which drains 36,460 square miles, is the principal part of the area. The gauges on this river at Mount Carmel and Vincennes have not, however, been established a sufficient length of time to make the records of much use in estimating the effects of rises in the Wabash on the subsequent rise at Cairo.

Some idea can be formed of the rises likely to take place at Cairo from the observed river stages at Evansville, and in certain cases from the observed stages at Paducah in combination with the stages at St. Louis.

The main reliance in predicting the Cairo stages will be the stages at St. Louis, Cincinnati, Nashville, and Chattanooga.

The stage at Cincinnati is the principal stage producing a rise at Cairo.

The following are the numbers of times the wave-crests or highest stages at Cairo have occurred on various numbers of days, from three to fourteen, after the occurrence of a crest at Cincinnati:

CAIRO CREST AFTER CINCINNATI CREST.

[Number of cases, years 1858 to 1890.]

Days after Cincinnati.	Cases.	Days after Cincinnati.	Cases.
3	1	9	3
4	4	10	4
5	5	11	2
6	41	12	1
7	9	13	0
8	5	14	1

The following give the principal crest-stages at Cincinnati and Cairo and the stages at certain dates about the times of crests at Chattanooga, Nashville, and St. Louis:

Cairo.		Cincinnati.		Cairo.		Cincinnati.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1858.				1859.			
		10	32.0			25	38.0
June 16	48.9	16	43.7	May 1	41.6	1	51.3
June 20	49.5			May 7	46.8		
June 22	49.5			1860.			
1859.						11	15.8
		17	26.3	Jan. 17	33.0	17	47.0
Mar. 23	42.0	23	40.3	Jan. 23	37.3		
Mar. 29	45.0						
Apr. 1	45.4					11	20.1
				Apr. 17	22.7	17	49.1

Cairo.		Cincinnati.		Cario.		Cincinnati.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1860.				1866.			
Apr. 23	32.0			May 2	42.0		
Apr. 24	32.2					3	29.6
1861.				Dec. 9	28.5	9	31.7
		14	27.8	Dec. 15	29.5		
Jan. 20	28.7	20	41.6	Dec. 19	31.0		
Jan. 26	35.1			1867.			
						16	45.0
		13	18.7	Feb. 22	47.4	22	54.1
Feb. 19	30.8	19	36.9	Feb. 26	50.2		
Feb. 22	32.4			Feb. 28	49.7		
Feb. 25	31.9						
						9	52.9
		14	39.0	Mar. 15	50.4	15	55.7
Apr. 20	42.9	20	49.4	Mar. 20	51.0		
Apr. 24	43.2			Mar. 21	51.0		
Apr. 26	43.0						
						15	22.9
		4	19.0	Apr. 21	37.9	21	35.8
May 10	31.9	10	35.9	Apr. 25	39.4		
May 16	42.5			Apr. 27	39.3		
May 18	43.1						
1865.						23	18.1
		8	26.3	May 29	33.6	29	30.2
Jan. 14	29.6	14	39.7	June 4	39.7		
Jan. 18	33.2			June 6	40.2		
Jan. 20	32.4			1868.			
						4	27.2
		2	41.6	Jan. 10	25.7	10	43.3
Mar. 8	44.9	8	56.2	Jan. 15	31.0		
Mar. 14	47.7			Jan. 16	31.0		
Mar. 18	47.9						
						12	31.5
		8	27.3	Mar. 18	37.0	18	43.7
May 14	35.8	14	51.3	Mar. 23	40.4		
May 20	38.7			Mar. 24	40.4		
May 23	39.3						
						12	28.9
		24	38.0	Apr. 18	39.6	18	39.5
Dec. 30	30.9	30	41.5	Apr. 23	42.7		
1866.				Apr. 24	42.6		
Jan. 4	34.6						
Jan. 5	34.6					3	21.6
				May 9	38.1	9	38.0
		21	23.9	May 15	44.0		
Jan. 27	31.3	27	36.8	May 19	45.6		
Feb. 1	32.6			1872.			
Feb. 2	32.5			Apr. 7	19.0	7	15.9
				Apr. 13	36.2	13	41.8
		22	25.5	Apr. 19	39.2		
Feb. 28	33.9	28	38.0	1873.			
Mar. 5	36.7					8	32.2
Mar. 6	36.7			Feb. 14	29.4	14	24.2
				Feb. 20	38.7	20	41.4
		8	21.3	Feb. 26	41.6		
Mar. 14	34.6	14	31.4				
Mar. 19	41.2						
Mar. 20	40.8					24	26.6
				Mar. 31	31.0	30	39.5
		21	22.8	Apr. 6	35.7	5	36.4
Apr. 27	40.8	27	37.0	Apr. 12	40.6		
May 1	42.6						

Cairo.		Cincinnati, six days.		Chattanooga, six days.		Nashville, three days.		St. Louis, four days.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1873.									
		6	28.8	6	------	------	------	8	17.9
May 12	34.4	12	38.7	12	------	------	------	12	20.9
May 18	38.5								
		28	26.4						
Dec. 4	18.0	4	25.5	------	------	7	19.1	6	6.5
Dec. 10	25.2	10	30.6	------	------	10	26.2	10	5.9
Dec. 16	32.0								
								14	14.0
Dec. 12	26.8	12	28.8	------	------	15	18.4	15	15.3
Dec. 18	33.5	18	44.4	------	------	18	11.9	18	13.6
Dec. 24	31.5								
1874.									
		1	13.3						
Jan. 7	11.9	7	26.5	------	------	10	30.0	9	6.3
Jan. 13	27.9	13	46.8	------	------	13	30.5	13	5.7
Jan. 20	29.3								
								23	8.4
		21	22.3	------	------	24	13.0	26	15.2
Jan. 27	27.6	27	35.9	------	------	27	20.0	27	14.2
Feb. 2	33.0	------	------	------	------	29	23.2		
1875.									
		28	16.1	28	4.9	31	21.7	30	3.5
Jan. 3	20.0	3	33.2	3	12.5	3	29.3	3	2.3
Jan. 9	24.4	------	------	5	14.6	5	30.2	5	4.9
				26	8.5				
		26	16.9	1	20.7	29	23.8	28	19.9
May 2	30.3	2	24.6	2	19.0	2	33.8	2	24.4
May 8	37.0	------	------	------	------	3	34.2	3	24.6
		23	14.7	23	5.6	26	16.4	25	7.2
Nov. 29	19.9	29	29.8	29	6.8	29	22.0	29	5.9
Dec. 5	21.8								
1876.									
		24	11.6	24	4.2	27	16.8	26	7.0
Dec. 30	25.9	30	47.7	30	33.0	30	26.2	30	7.0
Jan. 5	35.6	------	------	31	34.3	1	28.9	7	17.5
Jan. 8	39.0								
		27	17.9	27	6.2	30	7.9	29	28.4
May 3	34.5	3	19.1	3	12.2	3	7.6	3	27.0
May 9	37.7	------	------	4	13.2	------	------	6	27.8
		14	32.4	14	10.0	17	34.0	16	10.4
1877.									
				19	23.6	------	------	17	10.2
Jan. 20	28.6	20	53.3	20	22.1	20	38.4	20	9.9
Jan. 26	36.4	------	------	------	------	22	40.5		
Jan. 28	37.0								
		23	8.5	23	6.8	26	8.9	25	11.2
				27	15.0	------	------	28	13.8
Nov. 29	17.8	29	31.7	29	10.6	29	13.7	29	13.4
Dec. 5	23.0	------	------	------	------	30	14.3		

Cairo.		Cincinnati, six days.		Chattanooga, six days.		Nashville, three days.		St. Louis, four days.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1878.									
		27	10.8	27	7.8	30	9.5	29	16.6
						31	11.2		
Jan. 2	26.2	2	17.7	2	10.1	2	10.0	2	17.4
Jan. 8	24.1								
		26	24.2	26	6.5	29	8.2	28	11.6
								30	13.6
Feb. 1	25.4	1	25.2	1	1.6	1	20.1	1	12.4
Feb. 7	27.4								
		7	24.5	7	7.8	10	13.4	9	15.8
								12	22.8
Mar. 13	32.9	13	30.2	13	7.4	13	16.5	13	22.6
Mar. 19	35.1			16	10.6	14	17.5		
		9	28.7	9	6.2	12	16.7	11	9.2
Dec. 15	27.2	15	41.3	15	10.0	15	16.9	15	8.6
Dec. 21	26.8			17	11.7				
1879.									
		27	32.3	27	7.4	30	12.5	29	9.8
Feb. 2	30.7	2	40.2	2	1.6	2	15.5	31	10.2
Feb. 8	34.0					3	16.8	2	10.1
		24	30.3	24	6.8	27	21.7	26	12.9
				26	6.9				
Mar. 30	32.4	30	39.2	30	6.2	30	17.3	30	11.2
Apr. 5	31.5								
				21	8.0	24	21.1	23	5.0
		21	17.6	26	21.9				
Dec. 27	31.2	27	42.8	27	21.6	27	34.6	27	4.0
1880.									
Jan. 2	37.2					28	35.4		
		11	14.0	11	4.4	14	42.2	13	8.6
Feb. 17	35.7	17	53.2	17	26.8	17	43.9	17	10.2
Feb. 23	43.0					19	44.5	20	11.6
Feb. 24	43.4								
								13	11.1
		12	43.6	12	28.4	15	43.7	14	11.6
Mar. 18	44.2	18	41.2	18	38.3	18	46.1	18	10.0
Mar. 24	44.5					20	46.5		
		2	10.5	2	23.4	5	24.1	4	4.8
Dec. 8	26.2	8	37.0	8	17.4	8	25.4	8	4.8
Dec. 14	30.2								
1881.									
		18	23.3	18	8.6	21	28.3	20	8.6
				23	18.8				
Jan. 24	29.7	24	35.8	24	17.4	24	32.8	24	8.4
Jan. 30	31.6					25	33.0		
		4	18.2	10	13.6			11	18.0
Feb. 10	22.0	10	34.8	13	22.4	13	14.8	12	17.4
Feb. 16	38.8	16	50.5	16	14.7	16	13.8	16	13.6
Feb. 22	41.7								

Cairo.		Cincinnati, six days.		Chattanooga, six days.		Nashville, three days.		St. Louis. four days.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1881.									
		12	28.0	12	6.1	15	8.8	14	19.4
Mar. 18	32.6	18	30.5	18	10.6	18	9.0	18	21.7
Mar. 24	39.5			20	19.3	23	18.4	20	22.3
		11	35.6	11	8.7	14	19.0	13	27.0
				15	18.0	16	31.8		
Apr. 17	44.8	17	42.6	17	16.0	17	31.5	17	27.8
Apr. 23	45.1								
		9	10.7	9	4.0	12	11.9	11	20.8
						13	13.9		
June 15	23.1	15	35.0	15	3.6	15	10.5	15	22.4
June 21	30.5							21	24.7
June 22	30.8								
1882.									
Jan. 10	37.1	10	37.6	10	29.5	13	45.1	12	12.6
Jan. 16	42.2	16	48.5	16	30.2	16	49.3	16	13.2
Jan. 22	46.0			19	40.2				
		15	45.2	15	20.5	18	37.4	17	10.3
Feb. 21	47.4	21	58.6	21	15.5	21	38.0	21	27.5
Feb. 27	51.7					22	38.3	22	28.2
				18	10.1			20	18.2
		18	26.7	19	11.5	21	17.7	23	18.8
Mar. 24	42.4	24	46.9	24	9.8	24	19.2	24	18.5
Mar. 30	41.6								
				10	4.9				
May 10	35.0	10	30.7	14	6.8	14	16.5	12	24.4
May 16	41.7	16	46.4	16	5.7	16	15.5	16	24.1
May 22	42.5								
1883.									
		18	15.2	18	17.0	21	19.8	20	5.7
				23	38.2				
Jan. 24	20.6	24	31.3	24	37.9	24	30.2	24	5.2
Jan. 30	30.7					25	30.3		
				9	14.8	12	40.3		
Feb. 9	33.0	9	56.3	10	17.6	14	41.6	11	5.8
Feb. 15	43.3	15	66.3	15	13.1	15	41.5	15	20.0
Feb. 21	51.8							18	25.8
						6	33.5		
		3	43.3	3	26.2	7	35.8	5	15.4
Apr. 9	41.6	9	46.5	9	17.0	9	35.4	9	17.0
Apr. 15	44.2							10	17.2
		17	16.8	17	2.5	20	6.7	19	10.8
Nov. 23	20.7	23	21.2	23	6.2	23	9.6	23	11.4
Nov. 29	28.0			25	10.9	28	16.7		
1884.									
		22	11.2	22	5.5	25	30.0	24	5.4
Dec. 28	28.5	28	49.5	28	13.0	28	33.7	28	4.6
Jan. 3	35.3								
		28	16.0	28	8.6	31	21.1	30	11.0
Feb. 3	28.7	3	49.6	3	24.6	3	34.4	3	9.5
Feb. 9	43.8			4	25.5			6	15.5

Cairo.		Cincinnati, six days.		Chattanooga, six days.		Nashvillle, three days.		St. Louis, four days.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1884.									
		30	21.2	30	7.5	2	31.3	1	11.6
Feb. 5	34.2	5	53.5	5	20.4	5	37.8	5	12.7
Feb. 11	45.8							6	15.5
		2	47.1	2	19.5	5	37.8	4	10.4
								6	15.5
Feb. 8	42.3	8	62.9	8	21.7	8	40.4	8	14.2
Feb. 14	48.2			11	36.8				
Feb. 22	51.8								
		5	53.5	5	20.4	8	40.4	7	15.0
Feb. 11	45.8	11	66.8	11	36.8	11	42.6	11	10.8
Feb. 17	50.3					15	47.2	14	14.4
Feb. 22	51.8								
		8	62.9	8	21.7				
				11	36.8	11	42.6	10	11.8
Feb. 14	48.2	14	71.1	14	31.0	14	46.4	14	14.4
Feb. 20	51.5					15	47.2	19	15.6
Feb. 22	51.8								
		5	19.0	10	42.8	14	47.9		
Mar. 11	36.1	11	40.9	11	42.3	16	48.3	13	10.0
Mar. 17	42.1	17	49.6	17	24.9	17	47.8	17	10.4
Mar. 23	47.2								
1885.									
				14	17.6				
Jan. 14	32.9	14	24.2	18	26.5	17	30.8	16	14.6
Jan. 20	36.8	20	46.0	20	18.4	20	37.4	20	12.3
Jan. 26	39.0					21	37.8		
		2	10.8	2	6.1	5	10.4	4	18.0
Apr. 8	25.7	8	33.0	8	5.8	8	12.0	6	20.8
Apr. 14	31.5					9	12.7	8	20.0
1885.									
		15	26.5	15	4.4	18	7.7	17	18.8
Apr. 21	31.0	21	36.8	21	15.5	21	17.2	21	20.2
Apr. 27	38.0					22	19.4		
Apr. 28	38.2								
		31	12.5	6	6.5	6	11.2	8	12.0
Nov. 6	18.0	6	16.2	9	30.4	9	22.3	9	12.6
Nov. 12	25.3	12	20.0	12	18.4	12	26.1	12	11.6
Nov. 18	25.6								
		11	13.5	11	10.8	14	13.0	13	4.1
				16	21.4				
Dec. 17	18.6	17	30.1	17	19.4	17	20.1	17	2.2
Dec. 23	24.5					18	21.2		
1886.									
				12	9.0			13	23.2
Feb. 12	23.8	12	21.7	14	13.1	15	32.1	14	19.7
Feb. 18	37.4	18	40.5	18	8.5	18	35.3	18	16.4
Feb. 24	37.7								
		3	52.8	3	52.2	6	47.6	5	22.2
								7	22.0
Apr. 9	47.8	9	55.8	9	38.2	9	48.9	9	21.3
Apr. 15	50.2					10	49.3		
Apr. 19	51.0								

Cairo.		Cincinnati, six days.		Chattanooga, six days.		Nashville, three days.		St. Louis, four days.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1886.									
		10	29.2	10	10.0	13	28.9	12	25.5
								13	27.0
May 16	39.1	16	36.8	16	7.8	16	14.5	16	26.5
May 22	38.2								
								18	6.1
				17	2.4	20	8.7	19	5.8
Nov. 23	7.4	23	23.5	23	7.0	23	20.8	23	5.7
Nov. 29	23.0	29	30.2	28	13.7	27	22.8		
Dec. 4	19.9								
		14	10.2	14	8.2	17	6.7	16	3.2
Dec. 20	10.3	20	24.7	20	14.0	20	16.4	20	4.1
Dec. 26	20.9			22	16.6	23	20.9		
Dec. 27	21.1								
1887.									
				26	21.8				
		30	43.0	30	13.8	2	37.0	1	6.8
Feb. 5	38.8	5	56.2	5	19.0	5	41.5	5	5.4
Feb. 11	43.6								
Feb. 22	• 45.9	22	45.1	22	19.0	25	38.5	24	16.4
Feb. 28	47.0	28	54.5	28	27.3	28	43.8	28	15.1
Mar. 6	47.3					2	44.2		
Mar. 9	48.5								
		19	22.2	19	4.4	22	11.6	21	15.4
								24	19.5
Apr. 25	30.3	25	49.3	25	18.0	25	16.1	25	19.0
May 1	39.3			27	21.2	26	17.8		
1888.									
		24	17.5	24	6.3	27	12.8	26	15.6
Mar. 1	28.7	1	24.1	1	8.0	1	15.0	1	13.8
Mar. 7	26.8								
		25	23.5	25	7.2	28	33.0	27	24.8
						30	39.2	28	25.6
Mar. 31	43.8	31	39.8	31	27.0	31	39.1	31	23.4
Apr. 6	45.2								
		20	6.2	20	2.0	23	10.1	22	16.1
Aug. 26	19.1	26	32.0	26	4.2	26	12.4	26	15.3
Sept. 1	24.1								
		23	28.0	23	4.9	26	6.6	25	5.4
				28	20.0				
Oct. 29	16.2	29	33.0	29	18.5	29	11.0	29	5.4
Nov. 4	22.4					31	16.2		
		3	27.8	3	7.4	6	6.8	5	5.3
Nov. 9	20.2	9	33.5	9	5.8	9	17.4	9	6.4
Nov. 16	31.4								
1889.									
		3	22.3	3	5.6	6	15.2	5	4.9
Jan. 9	17.9	9	31.5	9	11.3	9	21.8	9	5.0
Jan. 15	26.1			11	12.4	10	23.4		
Jan. 21	30.7								

Cairo.		Cincinnati, six days.		Chattanooga, six days.		Nashville, three days.		St. Louis, four days.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1889.									
		16	14.4	16	6.6	19	31.8	18	6.7
				18	29.6	21	35.8		
Feb. 22	28.1	22	38.1	22	27.1	22	35.2	22	5.6
Feb. 28	32.1								
		3	16.2	3	6.9	6	13.4	5	16.6
						8	14.2		
Mar. 9	27.1	9	27.8	9	6.3	9	13.4	9	13.3
Mar. 15	23.8	14	17.4	14	5.8	17	19.2	16	15.0
				19	10.7				
June 20	29.2	20	28.9	20	28.9	20	25.4	20	16.6
June 26	23.5					21	25.9	22	18.4
1890.									
		15	34.5	15	4.6	18	25.1	18	14.4
Jan. 21	43.7	21	43.8	21	7.0	21	35.2	21	10.5
Jan. 27	42.6			23	13.0	24	35.7		
		5	35.0	5	7.2	8	33.7	7	11.2
				10	20.4				
Feb. 11	38.3	11	43.2	11	17.8	11	37.4	11	10.4
Feb. 17	41.8					12	38.1	16	11.2
1890.									
		23	43.0	23	7.2	26	37.3	25	8.6
								28	9.1
Mar. 1	42.1	1	56.8	1	40.2	1	47.2	1	8.4
Mar. 7	47.2			2	42.5	6	50.6		
Mar. 12	48.8								
		20	46.5	20	11.7	23	37.5	22	11.5
				25	27.2				
Mar. 26	46.7	26	59.1	26	26.0	26	40.6	26	11.7
Apr. 1	48.5					28	40.9	30	15.0
Apr. 3	48.7								
		22	37.0	23	11.9	24	28.3		
		24	40.3	24	11.6	27	19.6	26	14.0
May 30	33.8	30	41.3	30	7.4	30	19.2	30	12.4
June 5	30.6								
1891.									
		31	25.9	31	9.3	3	20.3	2	3.7
Jan. 6	28.5	6	48.7	6	15.2	6	23.3	6	4.7
Jan. 12	32.2								
		19	41.5	19	18.2	22	20.9	21	4.8
Feb. 25	44.3	25	57.3	25	29.0	25	27.3	25	10.7
Mar. 3	46.1					26	29.1	27	11.5
Mar. 4	46.2								
		6	33.0	6	20.0			8	7.6
				11	38.9	9	47.9	9	8.0
Mar. 12	44.8	12	43.3	12	37.6	12	48.7	12	7.8
Mar. 18	44.5					13	49.2		
				1	15.4	3	26.3	3	19.4
Apr. 1	42.8	1	37.7	2	16.3	4	26.2		
Apr. 7	44.7	7	43.5	7	11.6	7	19.2	7	18.5
Apr. 13	43.3								

After trying various methods of predicting Cairo stages from the stages at points above, the following was found to give the most satisfactory results:

When the river at Cincinnati has been rising for at least six days and has reached a crest, the rise at Cairo in the next six days will be equal to the rise at Cincinnati in the preceding six days multiplied by the mean stage at Cincinnati on the day of the crest and six days before and by the factor 0.69 plus the three-day rise at Nashville preceding the day of the Cincinnati crest, multiplied by the mean stage at Nashville on the day of the crest and three days before and by the factor 0.62 plus the rise at Chattanooga in six days preceding the Cincinnati crest, multiplied by the mean stage at Chattanooga on the day of the Cincinnati crest and six days before and the factor 0.42 plus the four-day rise at St. Louis preceding the Cincinnati crest, multiplied by the mean stage at St. Louis on the day of the Cincinnati crest and four days before and the factor 0.32, the whole sum divided by the stage at Cairo on the day of the Cincinnati crest and multiplied by a factor given below dependent on the stage of the river at Cairo.

Cairo stage.	Factor.	Cairo stage.	Factor.	Cairo stage.	Factor.
15	.365	27	.324	40	.237
		28	.319		
16	.362	29	.314	41	.227
17	.360	30	.308	42	.216
18	.357			43	.204
19	.355	31	.304	44	.194
20	.353	32	.300	45	.182
		33	.294		
21	.352	34	.287	46	.171
22	.347	35	.283	47	.159
23	.343			48	.150
24	.337	36	.276	49	
25	.334	37	.270	50	
		38	.258		
26	.329	39	.248		

When the changes are falls instead of rises they enter the sum with a minus sign.

The agreement between the observed stages at Cairo and the stages computed according to the rule given is shown below for all the important rises for which there are records.

The probable errors of computed stages according to this rule are for stages from 20 to 30 feet, ±2.2 feet, 30 to 35 feet, ±2 feet; 35 to 45 feet, ±0.9 feet; 45 to 50 feet or over, ±1.4 feet.

CAIRO STAGES AND RISES IN SIX DAYS AND TO CRESTS.

Date.	Stage.	Rise in six days.	Additional rise to crest in feet.	Computed rise.	Residuals. Com.—obs.
1875.					
Jan. 3	20.0	4.4	....	7.5	3.1
May 2	30.3	6.7	....	3.9	—2.8
Nov. 29	19.9	1.9	....	5.1	3.2
Dec. 30	25.9	9.7	3.4 in 3 days	14.0	4.3
1876.					
May 7	35.0	6.9	0.3 in 1 day	0.2	—6.7
1877.					
Jan. 20	28.6	7.8	0.6 in 2 days	8.6	0.8
Nov. 29	17.8	5.2	....	7.6	2.4

Date.	Stage.	Rise in six days.	Additional rise to crest in feet.	Computed rise.	Residuals. Com.—obs.
1878.					
Jan. 2	26.2	—2.1	....	1.1	3.2
Feb. 1	25.4	2.0	....	1.8	—0.2
Mar. 13	32.9	2.2	....	1.5	—0.7
1879.					
Dec. 27	31.2	6.0	....	3.6	—2.4
1880.					
Feb. 17	35.7	7.3	0.4 in 1 day	6.9	—0.4
Dec. 8	26.2	4.0	....	5.3	1.3
1881.					
Jan. 24	29.7	1.9	....	4.5	2.6
Mar. 18	32.6	6.9	....	6.3	—0.6
Apr. 17	44.8	0.3	....	1.1	0.8
June 15	23.1	7.4	0.3 in 1 day	6.4	—1.0
1882.					
Feb. 21	47.4	4.3	....	1.9	—2.4
1883.					
Jan. 24	20.6	10.1	....	11.2	1.1
Nov. 23	20.7	7.3	....	1.4	—5.9
Dec. 28	28.5	6.8	....	9.9	3.1
1884.					
Feb. 3	28.7	15.1	....	11.4	—3.7
Feb. 5	34.2	11.6	....	8.9	—2.7
Feb. 8	42.3	5.9	3.6 in 8 days	4.6	—1.3
Feb. 11	45.8	4.5	1.5 in 5 days	2.9	—1.6
Feb. 14	48.2	3.3	0.3 in 2 days	1.8	—1.5
1885.					
Apr. 8	25.7	5.8	....	4.6	—1.2
Apr. 21	31.0	7.0	0.2 in 1 day	3.6	—3.4
Nov. 7	19.0	7.2	0.3 in 1 day	7.7	0.5
Dec. 17	18.6	5.9	....	7.3	1.4
1886.					
Apr. 9	47.8	2.4	0.8 in 4 days	—0.4	—2.8
May 16	39.1	—0.9	....	—0.2	0.7
Nov. 24	9.4	14.4	0.1 in 1 day	23.4	9.0
Dec. 20	10.3	10.6	0.2 in 1 day	13.7	3.1
1887.					
Apr. 25	30.3	9.0	....	8.5	—0.5
1888.					
Mar. 1	28.7	—1.9	....	1.2	3.1
Mar. 31	43.8	1.4	....	2.6	1.2
Aug. 26	19.1	5.0	....	6.3	1.3
Oct. 29	16.2	6.2	....	4.3	—1.9
Nov. 9	20.2	11.2	....	3.4	—7.4
1889.					
Jan. 9	17.9	8.2	4.6 in 6 days	5.3	—2.9
Feb. 22	28.1	4.0	....	6.4	2.4
Mar. 9	27.1	—3.3	....	—2.2	—1.1
June 20	29.2	4.3	....	3.1	—1.2
1890.					
Jan. 21	43.7	—1.1	....	1.8	2.9
Feb. 11	38.3	3.5	....	2.4	—1.1
Mar. 1	42.1	5.1	1.6 in 5 days	5.6	0.5
Mar. 26	46.7	1.8	0.2 in 5 days	2.2	0.4
May 28	33.6	—1.2	....	—0.3	0.9

Another rule derived for Cairo, which does not, however, give as good results as the above, is as follows:

Rule.—The six-day rise at Cairo after a crest at Cincinnati is equal to the six-day rise at Cincinnati multiplied by 0.37, plus the six-day rise at Chattanooga multiplied by 0.38, plus the three-day rise at Nashville multiplied by 0.31, and plus the four-day rise at St. Louis multiplied by 1.3, the whole sum multiplied by a factor equal to 0.30 plus 50 minus the square of gauge reading at Cairo on day of Cincinnati crest, divided by 1,900. The factor is as follows:

$$\left(0.30+\frac{(50-G)^2}{1,900}\right).$$

This factor for stages from 25 to 50 feet is given in table below.

Cairo.		Cairo.		Cairo.	
Stage.	Factor.	Stage.	Factor.	Stage.	Factor.
26	0.61	35	0.42	43	0.33
27	0.59			44	0.32
28	0.57	36	0.40	45	0.31
29	0.54	37	0.39		
30	0.51	38	0.37	46	0.31
		39	0.36	47	0.31
31	0.49	40	0.35	48	0.30
32	0.47			49	0.30
33	0.45	41	0.35	50	0.30
34	0.43	42	0.34		

The probable errors of computed stages according to this rule are as follows: For stages from 20 to 30 feet, ±2.1; 30 to 35 feet, ±2.3; 35 to 45 feet, ±1.4; 45 to 50 feet or more, ±2.3.

The comparative crests at Cincinnati and those following at Cairo are shown in the following table, with the average stages also at Chattanooga, Nashville, and St. Louis:

Cincinnati.	Chattanooga.	Nashville.	St. Louis.	Cairo, six days after.	Cincinnati.	Chattanooga.	Nashville.	St. Louis.	Cairo, six days after.
17	10	10	17	24.0	31	------	------	------	29.7
18	------	------	------	24.3	32	------	------	------	30.3
19	------	------	------	24.6	33	------	------	------	30.9
20	------	------	------	25.0	34	14	19	13	31.5
					35	------	------	------	32.3
21	------	------	------	25.3					
22	------	------	------	25.6	36	------	------	------	32.8
23	------	------	------	25.8	37	------	------	------	33.6
24	------	------	------	26.3	38	------	------	------	34.4
25	------	------	------	26.6	39	------	------	------	35.2
					40	------	------	------	35.7
26	10	23	12	26.8					
27	------	------	------	27.5	41	------	------	------	36.4
28	------	------	------	28.1	42	------	------	------	37.1
29	------	------	------	28.6	43	------	------	------	37.7
30	------	------	------	29.2					

Cincinnati.	Chattanooga.	Nashville.	St. Louis.	Cairo, six days after.	Cincinnati.	Chattanooga.	Nashville.	St. Louis.	Cairo, six days after.
44	------	------	------	38.5	57	------	------	------	48.5
45	18	30	12	39.3	58	------	------	------	48.8
					59	------	------	------	49.2
46	------	------	------	40.1	60	------	------	------	49.6
47	------	------	------	41.0					
48	------	------	------	41.8	61	------	------	------	49.8
49	------	------	------	42.7	62	------	------	------	50.2
50	------	------	------	43.4	63	------	------	------	50.6
					64	------	------	------	51.0
51	------	------	------	44.2	65	------	------	------	51.3
52	------	------	------	45.0					
53	------	------	------	45.7	66	------	------	------	51.6
54	------	------	------	46.5	67	37	46	14	51.8
55	------	------	------	47.3	68	------	------	------	------
					69	------	------	------	------
56	28	39	15	48.0	70	------	------	------	------

When the stages at Chattanooga, Nashville, and St. Louis differ from the above the Cairo stage is to be corrected as follows:

For Chattanooga above or below the stage given ±0.31 times difference.

For Nashville above or below the stage given ±0.06 times difference.

For St. Louis above or below the stage given ±0.17 times difference.

The examination of Cairo crests with reference to Evansville crests is of no particular value.

Paducah is 45.5 miles above Cairo. The difference in height above sea-level of the zeros of the gauges is 17.6 feet.

The comparative crests are as follows, which do not, however, give the Cairo stage accurately because of the water coming from the upper Mississippi River:

Crests.		Crests.	
Paducah.	Cairo, same day.	Paducah.	Cairo, same day.
32	34.1	44	45
33	34.9	45	46
34	35.7		
35	36.5	46	47
		47	48
36	37.3	48	48.8
37	38.1	49	49.6
38	39	50	50.4
39	40		
40	41	51	51.1
		52	51.8
41	42	53	
42	43	54	
43	44	55	

The rises at Cairo, on the average, are to those at Paducah as 1.0 to 0.8.

The rise at Cairo corresponds with the rise at Paducah when the upper Mississippi is stationary, as shown by the stages at St. Louis.

When the Paducah stage is stationary the rise at Cairo in three days is equal to the rise at St. Louis in the preceding three days multiplied by 1.03 and a factor equal to the St. Louis stage divided by the Cairo stage.

The important stages at Cairo, Paducah, and St. Louis since 1875 are given below:

Cairo.		Paducah.		St. Louis.	
Date.	Stage.	Date.	Stage.	Date.	Stage.
1875.					
				30	3.5
Jan. 2	18.6	2	20.0	2	2.5
Jan. 5	22.1	5	24.8	5	4.9
Jan. 8	24.6	8	26.8		
				28	19.9
May 1	28.7	1	19.6	1	22.0
May 4	34.2	4	22.9	4	24.2
May 7	37.6	7	28.1		
				24	7.4
Nov. 27	17.6	27	15.9	27	6.6
Nov. 30	21.4	30	22.2	30	5.2
Dec. 2	23.0	2	23.5		
1876.					
				30	7.0
Jan. 2	32.3	2	34.9	2	7.2
Jan. 5	35.7	5	37.3	5	16.0
Jan. 8	39.0	8	36.5		
				5	25.5
May 8	36.4	8	26.0	8	30.0
May 11	40.5	11	29.2	11	32.0
May 14	42.2	14	30.5		
				10	21.5
June 13	25.4	13	13.8	13	21.9
June 16	26.3	16	19.2	16	23.2
June 19	32.6	19	22.8		
1877.					
				19	10.0
Jan. 22	32.3	22	34.4	22	10.0
Jan. 25	35.7	25	37.0	25	9.8
Jan. 28	37.0	28	37.5		
				25	11.2
Nov. 28	16.9	28	12.6	28	13.8
Dec. 1	19.8	1	14.5	1	11.6
Dec. 4	23.6	4	15.0		
1878.					
				26	14.8
Dec. 29	21.4	29	13.3	29	16.6
Jan. 1	25.1	1	16.0	1	17.4
Jan. 4	27.0	4	19.1		
				27	10.4
Jan. 30	22.8	30	19.1	30	13.6
Feb. 2	26.4	2	21.8	2	12.0
Feb. 5	27.8	5	24.3		
				8	16.4
Mar. 11	30.0	11	23.5	11	21.8
Mar. 14	34.0	14	24.8	14	22.2
Mar. 17	35.7	17	28.6		

Cairo.		Paducah.		St. Louis.	
Date.	Stage.	Date.	Stage.	Date.	Stage.
1878.					
				20	15.8
Apr. 23	27.0	23	18.9	23	18.5
Apr. 26	34.1	26	25.9	26	21.6
Apr. 29	37.0	29	29.0		
1879.					
				17	8.7
Jan. 20	29.6	20	34.1	20	8.6
Jan. 23	34.9	23	37.3	23	8.6
Jan. 26	36.0	26	38.0		
				8	11.0
Dec. 11	20.3	11	18.3	11	13.1
Dec. 14	28.4	14	24.9	14	13.0
Dec. 17	30.0	17	26.9		
				24	4.5
Dec. 27	31.2	27	32.8	27	4.0
Dec. 30	35.7	30	36.8	30	5.4
1880.					
Jan. 2	37.2	2	37.0		
				15	9.4
Feb. 18	37.2	18	36.8	18	11.0
Feb. 21	41.2	21	40.1	21	11.6
Feb. 24	43.4	24	42.0		
				3	4.1
Dec. 6	20.4	6	21.0	6	5.3
Dec. 9	29.1	9	31.2	9	4.7
Dec. 12	31.5	12	31.5		
1881.					
				19	8.6
Jan. 22	25.2	22	26.0	22	8.5
Jan. 25	31.0	25	31.3	25	8.2
Jan. 28	32.6	28	32.3		
				16	20.1
Mar. 19	33.8	19	25.7	19	22.2
Mar. 22	38.6	22	31.0	22	21.1
Mar. 25	39.6	25	32.3		
				11	26.2
Apr. 14	41.0	14	32.2	14	27.4
Apr. 17	44.8	17	37.0	17	27.8
Apr. 20	45.8	20	38.3		
				13	21.8
June 16	24.1	16	12.4	16	22.3
June 19	28.2	19	18.8	19	23.8
June 22	30.8	22	19.0		
1882.					
				17	10.3
Feb. 20	46.1	20	45.8	20	18.2
Feb. 23	50.8	23	48.5	23	27.1
Feb. 26	51.9	26	50.0		

Cairo.		Paducah.		St. Louis.	
Date.	Stage.	Date.	Stage.	Date.	Stage.
1883.					
				21	5.8
Jan. 24	20.6	24	20.3	24	5.2
Jan. 27	26.7	27	27.0	27	5.8
Jan. 30	30.7	30	28.4		
				21	10.0
Nov. 24	21.0	24	14.2	24	11.2
Nov. 27	26.3	27	20.2	27	10.8
Nov. 30	28.1	30	23.1		
				25	5.1
Dec. 28	28.5	28	29.5	28	4.6
Dec. 31	33.5	31	33.5	31	8.0
1884.					
Jan. 3	35.3	3	34.8		
				13	12.2
Feb. 16	49.7	16	51.2	16	13.7
Feb. 19	51.2	19	53.0	19	15.6
Feb. 22	51.8	22	54.2		
				21	16.4
Mar. 24	47.4	24	45.9	24	18.4
Mar. 27	47.8	27	44.9	27	23.4
Mar. 30	48.6	30	43.7		
1885.					
				5	20.3
Apr. 8	25.7	8	15.2	8	20.0
Apr. 11	29.4	11	21.6	11	19.5
Apr. 14	31.5	14	22.8		
				19	20.4
Apr. 22	32.4	22	24.2	22	19.8
Apr. 25	35.4	25	28.2	25	23.8
Apr. 28	38.2	28	28.2		
				5	11.0
Nov. 8	19.6	8	13.2	8	12.0
Nov. 11	23.8	11	19.2	11	12.1
Nov. 14	26.5	14	21.8		
1886.					
				8	23.2
May 11	31.0	11	19.8	11	24.9
May 14	35.6	14	24.5	14	26.8
May 17	39.8	17	28.9		
				21	5.5
Nov. 24	9.4	24	9.5	24	5.8
Nov. 27	18.8	27	17.9	27	5.4
Nov. 30	23.8	30	22.3		
				18	3.3
Dec. 21	11.8	21	11.8	21	4.0
Dec. 24	17.9	24	17.3	24	3.9
Dec. 27	21.1	27	19.0		

Cairo.		Paducah.		St. Louis.	
Date.	Stage.	Date.	Stage.	Date.	Stage.
1887.					
				20	17.2
Feb. 23	46.1	23	43.4	23	16.4
Feb. 26	46.7	26	44.7	26	16.4
Mar. 1	47.1	1	45.3		
				23	19.0
Apr. 26	33.6	26	27.2	26	18.0
Apr. 29	38.0	29	33.4	29	17.1
May 2	39.4	2	34.3		
1888.					
				19	7.0
Feb. 22	23.6	22	19.8	22	10.3
Feb. 25	26.6	25	20.9	25	15.0
Feb. 28	29.0	28	21.2		
				25	20.0
Mar. 28	37.6	28	29.8	28	25.6
Mar. 31	43.8	31	37.9	31	23.4
Apr. 3	45.2	3	40.4		
				23	15.4
Aug. 26	19.1	26	11.0	26	15.3
Aug. 29	22.2	29	15.2	29	14.1
Sept. 1	24.1	1	17.6		
				26	5.3
Oct. 29	16.2	29	13.8	29	5.4
Nov. 1	20.2	1	18.4	1	5.2
Nov. 4	22.4	4	20.2		
				8	5.8
Nov. 11	22.8	11	20.7	11	7.9
Nov. 14	30.0	14	28.0	14	8.6
Nov. 17	31.2	17	28.4		
1889.					
				13	5.8
Jan. 16	26.2	16	22.2	16	8.0
Jan. 19	28.7	19	24.3	19	11.8
Jan. 22	30.6	22	25.3		
				17	4.9
Feb. 20	22.8	20	21.0	20	5.9
Feb. 23	29.7	23	28.0	23	5.2
Feb. 26	32.8	26	31.4		
				17	11.0
Mar. 20	21.2	20	13.5	20	12.8
Mar. 23	22.4	23	13.6	23	15.5
Mar. 26	25.3	26	17.6		
				15	15.5
June 18	27.6	18	20.0	18	14.7
June 21	31.0	21	24.8	21	18.0
June 24	34.5	24	27.6		

Cairo.		Paducah.		St. Louis.	
Date.	Stage.	Date.	Stage.	Date.	Stage.
1890.					
				11	9.4
Jan. 14	36.0	14	30.1	14	13.9
Jan. 17	41.7	17	37.5	17	14.2
Jan. 20	43.7	20	39.7		
				8	11.4
Feb. 11	38.3	11	35.4	11	10.4
Feb. 14	40.7	14	38.1	14	10.8
Feb. 17	41.8	17	38.7		
1890.					
				3	7.0
Mar. 6	46.7	6	46.7	6	5.5
Mar. 9	47.9	9	48.3	9	5.1
Mar. 12	48.8	12	48.4		
				25	11.7
Mar. 28	47.1	28	45.7	28	13.0
Mar. 31	48.1	31	46.6	31	14.5
Apr. 3	48.7	3	47.2		
				20	12.9
May 23	29.6	23	24.4	23	12.0
May 26	31.5	26	27.6	26	14.0
May 29	34.0	29	29.4		
				13	17.2
June 16	22.8	16	12.6	16	19.3
June 19	24.3	19	14.4	19	19.7
June 22	25.2	22	14.7		
				15	7.3
Sept. 18	15.2	18	14.0	18	7.0
Sept. 21	19.1	21	16.9	21	7.7
Sept. 24	20.4	24	16.7		
				26	8.6
Oct. 29	16.8	29	12.7	29	8.2
Nov. 1	19.4	1	16.2	1	8.4
Nov. 4	21.1	4	17.3		
				16	6.3
Nov. 19	18.8	19	16.2	19	6.6
Nov. 22	23.2	22	20.5	22	8.0
Nov. 25	24.3	25	20.5		
1891.					
				3	4.1
Jan. 6	28.5	6	26.8	6	4.7
Jan. 9	30.9	9	29.7	9	5.3
Jan. 12	32.2	12	30.7		
				23	8.1
Feb. 26	44.7	26	43.3	26	11.4
Mar. 1	45.8	1	45.5	1	10.7
Mar. 4	46.2	4	45.3		
				28	17.7
Mar. 31	42.2	31	36.4	31	19.3
Apr. 3	44.0	3	--------	3	19.4
Apr. 6	44.8	6	--------		

LA CROSSE, WIS.

The danger line at La Crosse is at 13 feet. The highest water, June 19, 1880, was 17.4 feet.

The distance to St. Paul is 130 miles.

The corresponding wave-crest water stages at St. Paul and at La Crosse about five days later are as follows:

St. Paul.	La Crosse, five days after.	
6		
7	8.3	±1.4
8	9.3	
9	10.2	
10	11.1	±1.3
11	11.9	
12	12.9	
13	13.5	
14	14.1	
15	14.6	
16	15.1	
17	15.5	
18		

The principal tributaries coming into the Mississippi between St. Paul and La Crosse are the Chippewa River, which drains 9,602 square miles, the St. Croix, draining 7,568 square miles, and the Black River, draining 2,880 square miles. The Root River, coming in just below La Crosse, drains 1,685 square miles.

The total drainage area of the Mississippi above St. Paul is 33,719 square miles.

The total drainage area of Mississippi above mouth of St. Croix River is 41,287 square miles.

DUBUQUE, IOWA.

The danger line at Dubuque is at 16 feet. The highest water, 21.8 feet, occurred April, 1870.

The distance from St. Paul to Dubuque is 228 miles.

The corresponding wave-crest stages at St. Paul and at Dubuque about five days later are as follows, not, however, very good for predicting stages:

St. Paul.	Dubuque, five days after.	
5	6.9	±2.2
6	7.6	
7	8.3	±2.0
8	9.8	
9	11.0	
10	12.4	±2.4
11	13.7	
12	15.1	
13	15.2	
14	15.3	
15	15.4	
16	15.4	
17	15.5	
18		

The Wisconsin River, draining 11,850 square miles, adds water to the Mississippi between St. Paul and Dubuque, likewise the Chippewa, and St. Croix rivers, and the Turkey River, draining 1,679 square miles.

The total drainage area of the Mississippi above the mouth of the Chippewa River is 53,116 square miles.

DAVENPORT, IOWA.

The danger line at Davenport is at 15 feet. The highest water, 20.9 feet, in 1868, was caused by an ice gorge. The high water of April 25, 1870, was 16.7 feet.

The distance from Davenport to Dubuque is 106.5 miles.

The difference in level of zeros of gauges is 44.5 feet.

The corresponding wave crests at Dubuque and at Davenport two days later are as follows:

Dubuque.	Davenport, two days after.		Dubuque.	Davenport, two days after.	
5	4.2	±0.8	14	11.3	
			15	12.0	
6	4.7				
7	5.3		16	12.7	±0.3
8	5.8	±0.7	17	13.6	
9	6.7		18	14.5	
10	7.6	±0.6	19	15.5	
			20	16.4	
11	8.6				
12	9.7		21	17.3	
13	10.5		22		

The important tributaries joining the Mississippi between Dubuque and Davenport are the Makoqueta, draining 1,836 square miles, and the Wabsipinicon, draining 2,490 square miles.

The Rock River, which comes into the Mississippi just below Davenport, drains 10,690 miles.

The total drainage area of the Mississippi above Davenport, including the drainage area of Rock River, is 93,364 square miles.

KEOKUK, IOWA.

The danger line at Keokuk is at 14 feet. The high water of 1851 was 21 feet; that of July 4, 1867, 15.9 feet.

The difference in the level of zeros of gauges at Keokuk and Dubuque is 101.5 feet.

The distance from Dubuque to Keokuk is 235.25 miles.

The corresponding wave-crest water stages at Dubuque and at Keokuk about four days later are as follows:

Dubuque.	Keokuk, four days after.		Dubuque.	Keokuk, four days after.	
4	1.0		14	12.0	
5	2.3	±1.2	15	12.4	±1.3
6	3.5		16	13.0	
7	5.0	±1.7	17	13.6	
8	6.7		18	14.4	
9	8.0		19	15.3	
10	9.0	±1.2	20	16.3	±0.9?
11	9.9		21	17.2	
12	10.6		22	18.2	
13	11.4		23		

The important tributaries carrying water to the Mississippi between Dubuque and Keokuk are the Makoqueta, draining 1,836 square miles; the Wabsipinicon, draining 2,490 square miles; the Rock River, draining 10,690 square miles; the Iowa River, draining 12,250 square miles, and the Skunk River, draining 4,322 square miles.

The Des Moines River, coming in at Keokuk, drains 14,955 square miles.

The total drainage area of the Mississippi above Keokuk, including the drainage area of the Des Moines, is 126,203 square miles.

The stages at Davenport and at Keokuk about four days later are as follows:

Davenport.	Keokuk.
9.2	9.5
12.5	13.4
17.3	17.3

LOUISIANA BRIDGE, MISSOURI.

The danger line at Louisiana bridge, Missouri, is at 12 feet. The highest water, 21.94 feet, occurred in 1851. In 1881 there was a stage of 18.7 feet.

The distance from Louisiana bridge to Keokuk is 89.75 miles; the difference in level of the zeros of the gauges is 40.5 feet.

A stage of 11.9 feet at Keokuk corresponds to 11.7 feet at Louisiana bridge two days later; 17.2 at Keokuk corresponds to 16.2 at Louisiana bridge.

The principal tributary coming into the Mississippi between Keokuk and Louisiana bridge in addition to the Des Moines is the Salt River, draining an area of 2,741 square miles.

BEARDSTOWN, ILL.

The danger line at Beardstown, Ill., on the Illinois River, is at 12 feet. The highest water, 21.3 feet, occurred in 1882.

The distance from Beardstown to Peoria is 65 miles; the difference in level of the zeros of the gauges is 10 feet.

The record of gauge readings at Peoria and Beardstown have not as yet been kept long enough to permit of making a table of corresponding wave-crest stages The highest corresponding stages observed are given below:

Peoria.		Beardstown.	
Date.	Stage.	Date.	Stage.
1885.		1885.	
Nov. 12	12.0	Nov. 20	10.3
1886.		1886.	
Jan. 8	14.2	Jan. 17	13.4
Feb. 19	16.0	Feb. 26	16.0
Mar. 25	15.4	Mar. 30	14.0
1887.		1887.	
Feb. 20	18.8	Feb. 23	16.5
1888.		1888.	
Mar. 5	13.6	Mar. 10	13.4
Mar. 31	14.1	Apr. 3	13.5
June 2	13.0	June 8	12.2
1889.		1889.	
June 23	11.0	June 27	12.0
1890.		1890.	
Jan. 20	12.3	Jan. 20	13.5
Apr. 13	13.2	Apr. 14	11.1
June 25	13.3	June 29	10.3
1891.		1891.	
Apr. 17	15.0	Apr. 24	12.8

The Sangamon River is the most important tributary coming into the Illinois between Peoria and Beardstown.

The Illinois River drains 27,465 square miles.

OMAHA, NEBR.

The danger line at Omaha is at 18 feet. The high water of April 24, 1881, was 23.8 feet.

The distance from Omaha to Sioux City is 135 miles; the difference in level of the zeros of gauges is 117.8 feet.

The corresponding wave-crest water stages at Sioux City and at Omaha about two days later are as follows:

Sioux City.	Omaha, two days after.	
8.0	9.0	
9.0	9.8	
10.0	10.8	±0.8
11.0	11.8	
12.0	12.8	
13.0	13.8	
14.0	14.6	
15.0	15.4	±0.6
16.0	16.0	
17.0	17.5	
18.0	19.0	
19.0	20.5	
20.0	22.0	
21.0	23.0	
22.0	23.8	

The principal tributary of the Missouri between Sioux City and Omaha is th Little Sioux River.

The following are the stages at some of the important rises:

Sioux City.		Omaha.		Sioux City.		Omaha.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1879.		1879.		1885.		1885.	
Apr. 7	15.2	Apr. 9	17.0	June 15	14.9	June 17	16.6
May 1,3,4	8.7	May 1	10.3	1886.		1886.	
June 6	11.7	June 7	13.2	June 9	11.8	June 11	12.9
June 16	14.2	June 18	15.6	July 9	11.6	July 11	10.9
June 26	14.8	June 28	17.0	1887.		1887.	
1880.		1880.		Mar. 26	17.4	Mar. 28	17.9
June 4	10.4	June 6	12.3	June 11	14.8	June 12	13.5
June 19	12.5	June 21	15.6	June 25	15.8	June 29	14.9
July 7	13.7	July 9	17.1	1888.		1888.	
Sept. 2	8.8	Sept. 4	10.5	Apr. 8	14.8	Apr. 9	15.2
1881.		1881.		Apr. 18	15.9	Apr. 19	15.9
Mar. 27	16.3	Mar. 27	16.0	May 8	11.1	May 10	11.4
Apr. 7	20.0	Apr. 9	22.0	May 29	13.5	May 30	13.1
Apr. 23	22.2	Apr. 24	23.8	June 13	14.2	June 14	13.9
May 31	11.5	June 2	12.3	June 28	16.3	June 30	16.3
June 14	14.1	June 16	14.2	July 10	15.3	July 11	14.9
1882.		1882.		Aug. 6	10.4	Aug. 7	10.3
Apr. 10	10.2	Apr. 11	11.6	1889.		1889.	
June 27	13.1	June 28	14.5	June 11	8.5	June 13	9.5
1883.		1883.		June 29	8.7	July 1	9.7
Apr. 17	12.1	Apr. 18	13.3	July 25	7.3	July 28	8.8
May 24	12.4	May 25	14.2	1890.		1890.	
June 3	10.3	June 4	11.6	Apl. 14	9.5	Apr. 15	10.0
June 25	12.9	June 28	14.2	May 27	9.7	May 29	9.0
July 9	13.2	July 8	15.2	June 7	13.5	June 9	12.9
1884.		1884.		July 7	11.8	July 8	11.6
Mar. 22	14.0	Mar. 24	15.5	July 19	10.7	July 20	10.6
Apr. 4	15.6	Apr. 6	17.0	1891.		1891.	
June 21	15.0	June 22	14.6	Apr. 10	10.6	Apr. 11	11.2
1885.		1885.					
Apr. 13	10.0	Apr. 14	10.7				

PLATTSMOUTH, NEBR.

The danger line at Plattsmouth is at 16.6 feet. The high water of July 4, 1864, reached 18.9 feet; that of April 24, 1881, was 19.2 feet.

The distance from Plattsmouth to Omaha is 28.6 miles; the difference in level of the zeros of the gauges is 17.5 feet.

The corresponding wave crests at Omaha and at Plattsmouth which occur less than one day after are as follows:

Omaha.	Plattsmouth.
12	9.6 ±0.8
13	10.3
14	11.0
15	11.7 ±0.6
16	12.4
17	13.3
18	14.0
19	14.8
20	15.5 ±0.2
21	16.2
22	17.1
23	18.2
24	19.2 (?)
25	

ST. JOSEPH, MO.

The danger line at St. Joseph is at 10 feet.

The distance from St. Joseph to Omaha is 188.3 miles; the difference of level of the zeros of the gauge is 164.6 feet.

The corresdonding wave-crest water stages at Omaha and at St. Joseph about two days later are as follows;

Omaha.	St. Joseph, two days after.
13	14.4
14	15.3
15	16.0
16	16.8
17	17.8
18	19.0
19	20.0
20	21.1
21	22.2
22	23.3
23	24.5

A very considerable volume of water is added to the Missouri between Omaha and St. Joseph by the Platte River.

KANSAS CITY, MO.

The danger line at Kansas City is at 21 feet. The high water of 1844 was 37 feet; that of April 30, 1881, was 26.3 feet.

The distance from Kansas City to Omaha is 281.5 miles. The difference in the level of the zeros of the gauges is 242.0 feet.

The corresponding wave-crest water stages at Omaha and at Kansas City two or three days later are as follows:

Omaha.	Kansas City, two or three days after.
10	14.8 ±1.4
11	15.3
12	15.8
13	16.6
14	17.3
15	18.1 ±1.2
16	18.7
17	19.4
18	20.4
19	21.4
20	22.4
21	23.3
22	24.3
23	25.3
24	26.3
25	

The Kansas River and Platte River are important tributaries, entering the Missouri between Omaha and Kansas City.

The stages preceding important rises are as follows:

Omaha.		Kansas City.		Omaha.		Kansas City.	
Date.	Stage	Date.	Stage	Date.	Stage	Date.	Stage
1875.		1875.		1878.		1878.	
Apr. 16	11.2	Apr. 17	13.2	May 28	16.8	May 31	18.0
Apr. 27	17.8	Apr. 30	17.8	June 8	17.5	June 10	19.5
June 6	11.2	June 5	14.7	June 25	17.8	June 28	19.4
June 27	15.2	June 29	17.5	July 26	14.4	July 29	18.5
1876.		1876.		1879.		1879.	
Apr. 16	13.2	Apr. 17	17.4	Apr. 9	17.0	Apr. 11	16.7
June 20	14.8	June 22	16.6	May 1	10.3	May 5	10.2
July 4	14.6	July 5	16.8	June 7	13.2	June 10	13.9
1877.		1877.		June 18	15.6	June 20	16.8
Apr. 7	16.1	Apr. 9	15.6	June 28	17.0	June 30	19.2
Apr. 22	10.5	Apr. 24	14.0	1880.		1880.	
May 29	14.2	June 3	18.8	June 6	12.3	June 7	11.5
June 13	17.4	June 13	21.0	June 21	15.6	June 22	14.5
June 30	15.2	July 1	19.5	July 9	17.1	July 10	16.7
July 21	13.8	July 18	16.5	Sept. 4	10.5	Sept. 6	12.1
		July 21	15.7	1881.		1881.	
1878.		1878.		Mar. 27	16.0	Mar. 30	18.6
Apr. 27	14.5	Apr. 29	14.4	Apr. 9	22.0	Apr. 12	20.3
		May 4	14.8			Apr. 13	21.2

Omaha.		Kansas City.		Omaha.		Kansas City.	
Date.	Stage	Date.	Stage	Date.	Stage	Date.	Stage
1881.		1881.		1887.		1887.	
Apr. 24	23.8	Apr. 30	26.3	June 12	13.5	June 15	19.0
June 2	12.3	June 3	16.4	June 29	14.9	July 2	18.9
June 16	14.2	June 18	17.0	1888.		1888.	
1882.		1882.		Apr. 9	15.2	Apr. 11	18.7
Apr. 11	11.6	Apr. 13	15.0	Apr. 19	15.9	Apr. 20	18.3
June 28	14.5	July 3	19.2	May 10	11.4	May 15	16.4
1883.		1883.		May 30	13.1	June 1	18.8
Apr. 18	13.3	Apr. 20	14.2	June 14	13.9	June 16	17.7
June 28	14.2	June 26	23.8	June 30	16.3	July 2	20.4
1884.		1884.		July 11	14.9	July 13	18.5
July 4	13.2	July 5	17.2	Aug. 7	10.3	Aug. 12	14.7
1885.		1885.		1890.		1890.	
Mar. 10	12.2	Mar. 17	12.8	Apr. 15	10.0	Apr. 14	9.6
Apr. 14	10.7	Apr. 16	11.7	May 29	9.0	May 28	10.0
June 17	16.6	June 19	19.1	June 9	12.9	June 11	17.2
1886.		1886.		July 8	11.6	July 8	12.7
June 11	12.9	June 11	14.7			July 14	13.5
July 11	10.9	July 11	11.0	July 20	10.6	July 21	12.6
1887.		1887.		1891.		1891.	
Mar. 28	17.9	Apr. 1	20.2	Apr. 11	11.2	Apr. 15	14.5

LEAVENWORTH, KANS.

The danger line at Leavenworth, Kans., is at 20 feet. The high water of April 29, 1881, was 25.8 feet.

The distance from Kansas City to Leavenworth is 30.5 miles; the difference in level of the zeros of the gauges is 24.2 feet.

The corresponding wave-crest water stages at Leavenworth and Kansas City about one day later are as follows:

Leavenworth.	Kansas City.	
12	13.3	+0.7
13	14.3	
14	15.3	
15	16.4	+0.6
16	17.5	
17	18.5	
18	19.8	
19	21.0	
20	22.2	
21	23.4	
22	24.3	
23	24.9	
24	25.4	
25	25.9	
26	26.4	
27	--------------	

The Kansas River enters the Missouri between Leavenworth and Kansas City.

There is a gauge at Manhattan, at the junction of the Big Blue River with the Kansas River, 127 miles above Kansas City.

BOONVILLE, MO.

The danger line at Boonville, Mo., is at 20 feet. The high water of 1844 was 33.62 feet; that of May 3, 1881, was 22.8 feet.

The distance from Boonville to Kansas City is 189.3 miles; the difference in level of the zeros of gauges is 150.3 feet.

The corresponding crests at Kansas City and at Boonville two or three days later are as follows:

Kansas City.	Boonville, three days after.
14	12.4
15	13.4
16	14.3
17	15.3
18	15.9
19	16.6
20	17.2
21	17.8
22	19.1
23	20.0
24	21.1
25	22.3

The most important tributary coming into the Missouri between Kansas City and Boonville is the Grande River.

JEFFERSON CITY, MO.*

*No observations taken now.

The danger line at Jefferson City is at 20 feet. The high water of 1844 was 28.5 feet.

The distance from Jefferson City to Kansas City is 240.5 miles; the difference in the level of the zeros of gauges is 193.3 feet.

The corresponding wave-crest water stages at Kansas City and Jefferson City two days later are as follows:

Kansas City.	Jefferson City, two days after.	Kansas City.	Jefferson City, two days after.
13	10.3	26	18.7
14	11.0	27	19.6
15	11.7 ±1.3	28	20.5
		29	21.4
16	12.3 ±0.6	30	22.3
17	13.2		
18	13.9	31	23.2
19	14.7	32	24.1
20	15.5	33	25.0
		34	25.9
21	16.3	35	26.8
22	17.0		
23	17.6	36	27.7
24	18.0	37	28.5
25	18.4		

The Grand River is the most important stream entering the Missouri River between Kansas City and Jefferson City.

HERMANN, MO.

The danger line at Hermann is at 21 feet. The high water of May 4, 1881, was 20.4 feet.

The distance from Hermann to Boonville is 95.9 miles; the difference in level of the zeros of gauges is 82.6 feet.

The corresponding wave crests at Boonville and at Hermann one day later are as follows:

Boonville.	Hermann, One day after.
14	13.2
15	13.8
16	14.6
17	15.4
18	16.5
19	17.4
20	18.3
21	19.4
22	20.2

The principal tributaries coming into the Missouri River between Boonville and Hermann are the Osage and Gasconade rivers.

ST. LOUIS, MO.

The danger line at St. Louis is at 30 feet. The highest water, 41.3 feet, occurred June 27, 1844.

The distance from St. Louis to Kansas City is 401.3 miles; the difference in level of the zeros of gauges is 337.7 feet. The distance from St. Louis to Dubuque is 438.5 miles; the difference in level of the zeros of gauges is 199.3 feet.

The stages of water at St. Louis do not follow very closely the stages at Kansas City and Dubuque; the stages are principally the result of the rainfall in drainage area below Kansas City and Dubuque, which is 130,000 square miles.

The stages of water at St. Louis were, February 9, 1881, 10.9; February 10, 17.7, and February 11, 18.0, a crest. The rainfalls in lower part of drainage area above St. Louis were as follows:

	Inches.
Des Moines, 5th to 8th	1.54
Davenport, 6th to 10th	0.78
Keokuk, 5th to 8th	0.90
Leavenworth, 5th to 7th	3.23
Boonville, 6th to 8th	2.28
Hermann, 6th to 10th	1.45
St. Louis, 7th to 9th	0.27
Springfield, Ill., 7th to 9th	0.38
Chicago, 7th to 11th	2.39

The stages of river at St. Louis were:

	Feet.
February 18, 1882	10.4
February 19	11.2
February 20	18.2
February 21	27.5
February 22	28.2 a crest

The rainfalls were as follows:

	Inches.
Des Moines, 17th to 22d	1.15
Dubuque, 17th to 22d	0.42
Davenport, 18th to 21st	0.16
Cedar Rapids, 18th to 21st	1.05
Keokuk, 18th to 21st	1.39
Leavenworth, 17th to 22d	0.87
Boonville, 19th and 20th	5.12
Hermann, 19th and 20th	4.93
Jefferson City, 19th and 20th	4.00
St. Louis, 19th and 20th	6.71

The stages of river at St. Louis were:

	Feet.
February 13, 1883	5.4
February 14	7.4
February 15	10.3
February 16	20.0
February 17	24.0
February 18	25.8 a crest

The rainfalls preceding were as follows:

	Inches.
Des Moines, 13th to 17th	0.85
Dubuque, 14th to 17th	0.75
Davenport, 16th	2.90
Cedar Rapids, 13th to 17th	1.25
Keokuk, 16th	3.56
Leavenworth, 13th to 17th	1.28
Boonville, 14th	0.72
Hermann, 14th and 15th	2.50
Jefferson City, 13th and 14th	1.00
St. Louis, 13th to 17th	2.38
Chicago, 16th	1.94

Important rises at St. Louis extend over at least six days. The average daily rises from a large number of cases are as follows:

	Feet.
6th to 5th	0.3
5th to 4th	0.4
4th to 3d	0.6
3d to 2d	0.9
2d to 1st	1.0
1st to crest	0.5

The average changes before crests when grouped according to the highest stage attained at St. Louis show no dependence in size on the St. Louis stage.

The stages of water at St. Louis corresponding to crest stages four days preceding at Kansas City and the stages five days before at Dubuque are as follows:

ST. LOUIS, MO.

Kansas City.	Dubuque.				Kansas City.	Dubuque.			
	5	10	15	20		5	10	15	20
5	16	18			22	23	28		
					23	24	29		
6	16	19			24	25	31		
7	17	20			25		32		
8	17	21	23	25					
9	18	21	24	25	26		34		
10	18	22	25	26	27				
					28				
11	19	22	25	26	29				
12	19	22	25	27	30				
13	20	22	25	27					
14	20	22	25	28	31				
15	20	22	25	28	32				
					33				
16	20	22	26	29	34				
17	21	23	27	29	35				
18	21	23	27	30					
19	21	24	28	30	36				
20	22	25	28	30	37				41
21	22	26	28						

Probable error ± 2.5.

There is no very definite relation between the rises at Kansas City and Dubuque and the subsequent rises at St. Louis.

The distance from St. Louis to Boonville is 212 miles; the difference in the level of the zeros of gauges is 187.4 feet.

The distance from St. Louis to Keokuk is 202.5 miles; the difference in the level of zeros of gauges is 97.74 feet.

The corresponding water stages at St. Louis and Boonville and Keokuk two days previous are as follows:

ST. LOUIS CRESTS $\pm$1.5.

[In feet.]

Boonville.	Keokuk.																
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
5				14													
6	14	14	14	14	15	16											
7	14	14	14	15	16	16											
8	14	14	14	15	16	17	18	19	20	21							
9	15	15	15	16	17	18	19	20	21	22							
10	15	16	16	17	18	19	20	21	22	23	24	25					
11	16	17	17	18	19	20	21	22	23	24	24	25					
12	17	18	18	19	20	21	22	23	24	25	25	26	27	27	28		
13	18	19	19	20	21	22	23	24	26	26	26	27	27	27	28	28	28
14	18	19	20	21	22	23	24	25	26	26	27	28	28				
15	19	20	21	22	23	24	25	26	26	27	27	28	29				
16	20	21	22	23	24	25	26	27	27	27	28	29	29				
17	21	22	23	24	25	26	27	27	27	28	28	29	30				
18		23	24	25	25	26	27	28	28	29	29	30					
19				26	26	27	27	28	28	29	30	31					
20				27	27	27	28	28	29	30	31	32					
21								29	30	31	32	33					
22								30	31	32	33	34					
23										33	34	35					

The drainage area of water passing St. Louis below Boonville and Keokuk excluding the Des Moines River is 61,740 square miles.

The rise at St. Louis in two days is equal, on the average, to 2.14 times the preceding two-day rise at Boonville.

The following are the stages for some of the important rises at St. Louis and the corresponding stages preceding at Kansas City, Dubuque, and Peoria; also the stages at St. Louis and those preceding at Boonville and Keokuk:

St. Louis.		Kansas City.		Dubuque.		Peoria.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1875.							
		6	8.0	6	11.1		
Apr. 10	19.1	10	11.3	10	10.0		
Apr. 14	19.8	13	12.2				
		25	14.8	25	16.4		
				26	16.5		
Apr. 29	20.8	29	17.6	29	16.1		
May 3	24.6	30	17.8				
		30	10.7	30	11.4		
June 3	16.9	3	13.1	3	11.4		
June 7	20.1	5	14.7				

St. Louis.		Kansas City.		Dubuque.		Peoria.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1875.							
		17	12.1	17	10.3		
June 21	23.0	21	14.1	21	10.3		
June 25	23.8	29	17.5				
July 8	27.8	8	16.3	8	9.4		
July 12	28.8	12	16.0	12	7.7		
		14	16.5				
		26	12.8	26	4.6		
		28	13.2				
July 30	24.0	30	12.9	30	3.8		
Aug. 3	29.8						
		6	12.0	6	5.3		
		7	14.0				
Sept. 10	15.8	10	13.8	10	7.8		
Sept. 14	19.5			16	9.8		
1876.							
		30	4.7	30	5.8		
Jan. 3	9.2	3	5.9	3	6.7		
Jan. 7	17.5						
		28	8.3	28	6.1		
Apr. 2	23.5	2	11.8	2	7.3		
Apr. 6	24.2	8	12.8				
		12	12.8	12	12.7		
				14	15.0		
Apr. 16	26.2	16	17.2	16	14.8		
Apr. 20	29.3	17	17.4				
		2	10.9	2	15.4		
May 6	25.4	6	14.1	6	16.0		
May 10	32.0	8	15.4				
		11	14.8	11	12.0		
				12	12.3		
June 15	22.6	15	17.0	15	10.9		
June 19	26.2	16	18.0				
		18	16.2	18	10.8		
June 22	24.5	22	16.6	22	10.0		
June 26	27.2			27	11.3		
		29	16.2	29	10.8		
				2	11.1		
July 3	24.3	3	16.3	3	11.0		
July 7	30.1	5	16.8				
		8	10.0	8	6.8		
				10	7.9		
Sept. 12	21.0	12	11.0	12	6.8		
Sept. 16	22.2	16	11.8				
1877.							
Apr. 8	19.4	8	14.8	8	6.5		
		9	15.6				
Apr. 12	22.8	12	13.1	12	6.0		

St. Louis.		Kansas City.		Dubuque.		Peoria.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1877.							
		16	11.8	16	6.2		
Apr. 20	19.6	20	13.9	20	6.9		
Apr. 24	23.6						
May 16	22.8	16	13.1	16	7.2		
May 20	25.6	20	15.0	20	6.5		
		22	18.1				
June 10	23.6	10	22.2	10	7.7		
June 14	26.6	14	21.0	14	7.8		
		26	18.8	26	7.8		
				27	8.0		
June 30	26.1	30	19.0	30	7.4		
July 4	26.6						
1878.							
		4	7.0	4	3.0		
Mar. 8	16.4	8	6.6	8	3.3		
Mar. 12	22.8	9	6.8				
		17	8.5	17	4.3		
Apr. 21	16.2	21	8.8	21	5.2		
Apr. 25	22.0						
		30	14.4	30	7.2		
May 4	20.8	4	14.8	4	8.5		
May 8	21.2						
		29	17.0	29	5.3		
		31	18.0				
June 2	23.4	2	17.2	2	7.4		
June 6	24.4			3	8.4		
		7	18.8	7	7.0		
		10	19.5				
June 11	25.0	11	19.3	11	6.5		
June 15	25.8						
		29	19.1	29	5.3		
				1	5.5		
July 3	21.8	3	19.8	3	5.3		
July 7	22.4						
		24	15.5	24	6.3		
July 28	17.6	28	18.3	28	7.3		
Aug. 1	20.2	29	18.5				
1879							
		25	16.8	25	5.5		
June 29	20.2	29	18.9	29	5.6		
July 3	21.2	30	19.2				
1880							
		7	11.5	4	9.2		
June 8	17.4	8	11.2	8	9.9		
June 12	20.2						
		4	15.5	4	14.8		
July 8	25.2	8	16.1	8	12.8		
July 12	25.5	10	16.7				

St. Louis.		Kansas City.		Dubuque.		Peoria.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1881							
		12	11.7				
Mar. 16	20.1	16	15.4				
Mar. 20	22.3						
		9	19.1	9	11.2		
				10	12.3		
Apr. 13	27.0	13	21.2	13	9.3		
Apr. 17	27.8						
		28	25.2				
		30	26.3	30	9.3		
May 2	32.1	2	25.0	2	9.8		
May 6	33.6						
		18	13.9	18	13.5		
May 22	24.8	22	15.5	22	12.8		
May 26	25.0						
		13	15.6	13	11.6		
				14	11.7		
June 17	22.5	17	16.6	17	11.2		
June 21	24.7	18	17.0				
		26	15.8	26	10.0		
				27	10.1		
June 30	22.9	30	16.0	30	10.0		
July 4	24.8	2	17.0				
		14	13.1	14	9.4		
July 18	21.6	18	12.5	18	7.4		
July 22	22.4			26	8.3		
		18	7.2	18	20.6		
Oct. 22	24.2	22	7.7	22	21.0		
Oct. 26	25.2			24	21.2		
		12	8.3	12	14.4		
		13	8.7				
Nov. 16	26.2	16	7.8	16	14.1		
Nov. 20	29.5						
1882.							
		16	6.0	16	6.2		
Feb. 18	10.4			17	6.3		
Feb. 20	18.2	20	3.5	20	6.1		
Feb. 22	28.2						
		4	6.5	4	7.5		
Mar. 8	16.6	8	7.5	8	8.5		
Mar. 12	20.1						
		23	10.2	23	15.8		
		24	10.5				
Apr. 27	24.3	27	9.5	27	14.4		
May 1	24.8						
		25	11.0	25	13.8	25	11.5
May 30	27.0	29	12.1	29	12.9	29	11.9
June 3	28.1	31	13.0			8	14.1
		27	17.0	27	10.5	27	14.7
						28	14.8
July 1	29.6	1	18.8	1	10.4	1	14.2
July 5	32.2	3	19.2	7	11.9		

St. Louis.		Kansas City.		Dubuque.		Peoria.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1883.							
Feb. 14	7.4						
Feb. 18	25.8						
		17	5.0				
Feb. 21	23.8	21	7.0				
Feb. 25	·26.2	26	8.2				
		15	10.0	15	8.7	17	13.7
Apr. 19	16.5	19	12.6	19	10.6	19	13.6
Apr. 23	20.5	20	14.2				
		15	....	15	12.8		
May 19	24.0	19	....	19	12.0		
May 23	26.5						
		18	21.2	18	10.3		
		20	22.7				
June 22	33.9	22	22.5	22	10.4		
June 26	34.8						
1884.							
				1	12.8	1	17.5
				3	13.2		
Apr. 5	26.0	....	....	5	13.0	5	16.0
Apr. 9	28.1						
				29	11.0		
May 3	21.8	....	....	3	10.7	3	
May 7	25.2						
				4	9.6	4	7.0
June 8	18.7	....	....	8	9.6	8	6.5
June 12	21.7						
				19	8.8		
				22	8.9	22	5.5
June 23	21.0	....	....	23	8.6	23	5.6
June 27	21.6						
		8	16.7	8	6.8	8	5.1
July 14	17.6	12	15.3	12	6.4	12	7.7
July 18	20.9	13	16.6				
		26	13.6	24	4.7	24	5.5
July 28	15.9	28	13.1	28	4.5	28	5.6
Aug. 1	17.2	1	13.5				
		24	9.8	24	14.5		
Sept. 28	17.0	28	8.0	28	13.7		
Oct. 2	22.2	29	9.2				
		6	7.9	6	11.6	6	5.8
Oct. 10	18.5	10	8.6	10	12.9	10	9.2
Oct. 14	20.4	....	....	16	14.6	11	9.4
1885.							
		8	8.0	8	....	8	9.3
Mar. 12	19.5	12	11.9	12	....	12	11.2
Mar. 16	24.1	17	12.8	....	....	20	15.0
		24	9.3	25	9.9	25	14.9
Apr. 29	25.8	29	10.9	29	9.8	29	14.1
May 3	26.1	2	12.8				

St. Louis.		Kansas City.		Dubuque.		Peoria.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1885.							
		23	10.4	23	9.0	23	8.4
May 27	17.6	27	11.2	27	9.5	27	7.4
May 31	20.2	2	12.8	30	10.3		
		9	13.3	9	8.5	9	7.5
June 13	20.6	13	16.7	13	7.9	13	7.0
June 17	27.1	19	19.1				
		9	16.0	9	8.2	9	4.3
July 13	20.4	13	15.3	13	7.5	13	5.7
July 17	20.6						
		7	10.2				
		9	10.8	9	4.8	9	5.4
Sept. 11	19.8	11	9.2	11	5.2	11	5.8
Sept. 15	22.2	-----	-----	-----	-----	18	7.3
1886.							
						7	10.2
Feb. 9	18.0	-----	-----	-----	-----	9	9.7
Feb. 13	23.2	-----	-----	-----	-----	19	16.0
						22	13.8
		22	14.3	23	7.4	25	15.4
Mar. 26	21.8	26	15.3	26	8.3	26	15.3
Mar. 30	23.2	27	15.4				
		13	12.1	13	9.0	13	12.3
Apr. 17	21.6	17	15.8	17	9.7	17	12.8
Apr. 21	23.7	-----	-----	-----	-----	20	13.6
		5	11.8	5	13.6	5	11.0
May 9	24.1	9	12.6	9	12.3	9	10.4
May 13	27.0	10	12.7				
		21	14.6	21	5.0	21	6.3
June 25	15.7	25	14.9	25	5.7	25	5.9
June 28	20.4	27	15.2	1	6.1		
1887.							
		11	9.0	11	8.5	11	13.7
				13	9.0		
Mar. 15	17.1	15	14.8	15	8.6	15	13.1
Mar. 19	20.1						
		26	12.0	24	6.0	26	10.9
Mar. 29	16.0	30	20.0	30	5.8	30	10.1
Apr. 3	20.6	1	20.2				
			11.4				
		29		29	14.6	29	5.5
May 3	17.1	3	10.2	3	13.0	3	5.1
May 7	18.6						
1888.							
		20	12.5	-----	-----	20	12.4
Mar. 24	19.2	24	12.3	-----	-----	24	12.3
Mar. 28	25.6	26	14.6	-----	-----	31	14.1
		7	18.1	7	8.6	7	12.8
Apr. 11	21.7	11	18.7	11	10.2	11	11.8
Apr. 15	23.2						

St. Louis.		Kansas City.		Dubuque.		Peoria.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1888.							
		16	15.9	16	21.9	16	7.0
May 20	26.8	20	14.2	20	20.3	20	6.7
May 24	28.0						
		27	15.7	27	16.5	27	7.9
May 31	29.1	31	18.4	31	16.0	31	12.2
June 4	29.4	1	18.8	2	16.4	2	13.0
		23	18.0	23	12.4	23	7.3
June 27	26.0	27	19.2	27	12.9	27	6.3
June 1	27.2	2	20.4				
		3	20.4	3	11.6	3	6.9
July 7	23.7	7	19.2	7	10.9	7	8.2
July 11	25.5	-----	-----	-----	-----	14	9.0
1889.							
		24	9.8	24	6.3	24	4.2
May 27	16.7	28	10.4	28	7.1	28	4.3
June 1	24.6	29	10.6	30	7.4		
1890.							
		22	14.8	22	12.5	22	12.4
June 26	19.7	26	13.8	26	14.2	26	13.3
June 30	20.7	30	15.5				
1891.							
		16	6.0	-----	-----	16	7.9
Mar. 20	7.4	20	9.4	-----	-----	20	8.2
Mar. 24	14.7	24	10.2	-----	-----	24	8.6
Mar. 30	19.0						
		25	10.2	25	-----	25	8.9
Mar. 29	18.4	29	11.5	29	6.5	29	9.6
Apr. 2	19.4						
		6	11.6	6	9.8	6	11.5
Apr. 10	18.1	10	10.2	10	10.8	10	11.6
Apr. 14	20.0	15	14.5				
		11	9.6	11	10.9	11	11.6
Apr. 15	19.5	15	14.5	15	11.3	15	14.8
Apr. 19	22.4						
		17	13.1	17	11.5	17	15.0
Apr. 21	22.5	21	13.8	21	11.8	21	14.9
Apr. 25	23.4						

St. Louis.		Boonville.		Keokuk.	
Date.	Stage.	Date.	Stage.	Date.	Stage.
1874.					
		13	5.6	13	7.3
May 15	14.4	15	5.0	15	7.4
May 17	16.0			19	7.6
		15	12.8	15	6.9
June 17	17.6	17		17	5.9
June 19	18.4	18	13.4		
		9	9.8	9	5.9
July 11	14.5	11	9.7	11	5.8
July 13	15.0				
1875.					
		12	4.7	12	5.8
Mar. 14	9.9	14	5.2	14	6.8
Mar. 16	12.2	16	5.8	15	7.1
		10	8.6	10	10.1
Apr. 12	19.2	12	8.7	12	9.6
Apr. 14	19.8	19	10.3		
		29	14.0	29	11.2
May 1	22.0	1	14.5	1	11.8
May 3	24.6	2	15.0	2	12.1
		3	8.6	3	8.0
June 5	18.0	5	11.4	5	7.8
June 7	20.1	6	12.1		
		21	12.8	21	9.7
June 23	23.2	23	14.3	23	9.3
June 25	23.8				
		8	18.7	8	12.8
				9	12.9
July 10	28.5	10	19.5	10	12.8
July 12	28.8				
		30	13.7	30	4.9
Aug. 1	25.6	1	16.5	1	5.2
Aug. 3	29.8				
1876.					
		2	12.0	2	7.3
Apr. 4	23.6	4	13.1	4	8.5
Apr. 6	24.2				
		16	15.7	16	16.3
				17	16.5
Apr. 18	28.2	18	16.9	18	16.4
Apr. 20	29.3	19	17.1		
		6	12.1	6	13.0
		7	17.9		
May 8	30.0	8	17.7	8	14.7
May 10	32.0				
		15	15.5	15	9.2
June 17	24.6	17	17.1	17	9.2
June 19	26.2				

St. Louis.		Boonville.		Keokuk.	
Date.	Stage.	Date.	Stage.	Date.	Stage.
1876.					
		22	15.1	22	9.2
June 24	23.9	24	15.5	24	9.2
June 26	27.0	26	17.2		
		3	15.7	3	8.8
July 5	25.5	5	17.5	5	13.4
July 7	30.1				
		12	13.2	12	12.1
Sept. 14	21.6	14	13.4	14	12.2
Sept. 16	22.2	16	13.5		
1877.					
		8	11.2	8	11.4
Apr. 10	20.2	10	14.6	10	11.6
Apr. 12	22.8				
		20	14.8	20	10.5
		21	15.0	21	10.7
Apr. 22	22.6	22	14.9	22	9.9
Apr. 24	23.6				
		16	14.9	16	8.5
May 18	23.5	18	17.1	18	9.1
May 20	25.6	23	17.7		
		10	18.2	10	7.5
June 12	25.8	12	19.6	12	6.8
June 14	26.6	13	19.9		
		27	18.0	30	9.2
		30	17.2	1	10.2
July 2	25.8	2	17.3	2	9.8
July 4	26.6				
1878.					
		8	8.7	8	2.8
Mar. 10	17.2	10	11.1	10	4.0
Mar. 12	22.8	11	11.7	11	5.3
		21	9.3	21	4.7
Apr. 23	18.5	23	9.6	23	6.1
Apr. 25	22.0				
		4	12.9	4	7.4
May 6	20.8	6	13.4	6	7.4
May 8	21.2	7	13.5		
		2	14.9	2	5.1
June 4	23.5	4	14.8	4	9.0
June 6	24.4			7	10.8
				10	11.0
		11	16.4	11	10.8
June 13	25.4	13	16.6	13	9.8
June 15	25.8				
		3	16.9	3	4.5
July 5	22.2	5	17.1	5	4.8
July 7	22.4				

St. Louis.		Boonville.		Keokuk.	
Date.	Stage.	Date.	Stage.	Date.	Stage.
1878.					
		28	14.9	28	4.9
July 30	19.4	30	16.3	30	5.1
Aug. 1	20.2			1	5.8
1879.					
				27	5.8
		29	17.5	29	5.1
July 1	21.0	1	17.9	1	4.6
July 3	21.2				
1880.					
		30	9.8	30	8.4
				31	8.5
June 1	17.1	1	9.7	1	8.3
June 3	17.8	8	11.4		
		8	11.4	8	8.6
June 10	18.5	10	11.0	10	9.1
June 12	20.2				
		8	14.1	8	14.0
July 10	25.4	10	14.7	10	13.0
July 12	25.5	12	15.1		
1881.					
			14.2		
Mar. 18	21.7		15.4		
Mar. 20	22.3				
		13	17.7	13	13.2
Apr. 15	27.6	15	18.0	15	13.2
Apr. 17	27.8			24	17.4
		2	22.3	2	13.9
		3	22.8		
May 4	33.2	4	22.6	4	12.7
May 6	33.6				
				17	14.6
		22	13.5	22	12.6
May 24	24.6	24	14.6	24	11.7
May 26	25.0				
		17	15.1	17	11.7
		18	16.0		
June 19	23.8	19	15.8	19	11.2
June 21	24.7			21	12.5
		30	15.3	30	12.0
		1	15.9		
July 2	24.0	2	15.4	2	11.1
July 4	24.8				
		16	13.1		
		18	12.7	18	15.6
July 20	22.1	20	12.4	20	14.4
July 22	22.4				
		22	11.8	22	17.8
Oct. 24	24.8	24	11.9	24	17.9
Oct. 26	25.2			29	18.8

St. Louis.		Boonville.		Keokuk.	
Date.	Stage.	Date.	Stage.	Date.	Stage.
1881.					
		16	9.7	16	14.8
Nov. 18	26.7	18	9.7	18	14.6
Nov. 20	29.5	19	9.9		
1882.					
		18	7.7	18	4.6
Feb. 20	18.2	20	9.2	20	4.8
Feb. 22	28.2	22	8.7	22	5.3
Feb. 24	25.6				
		8	7.3	8	7.1
Mar. 10	18.0	10	9.1	10	7.6
Mar. 12	20.1				
		24	12.4	24	15.8
		27	12.2	27	15.6
Apr. 29	24.6	29	11.8	29	14.8
May 1	24.8				
		30	12.9	30	13.9
		31	13.4		
June 1	27.8	1	13.2	1	14.5
June 3	28.1				
		1	19.1	30	15.0
		2	20.1	1	14.8
July 3	31.8	3	19.9	3	14.2
July 5	32.2				
1883.					
		14	9.4		
Feb. 16	20.0	16	14.7		
Feb. 18	25.8				
		16	14.7		
		21	11.8		
Feb. 23	24.5	23	10.7		
Feb. 25	26.2				
		19	10.9	19	8.2
Apr. 21	17.8	21	12.6	21	8.2
Apr. 23	20.5				
				18	15.2
		19	....	19	14.8
May 21	26.0	21	....	21	13.7
May 23	26.5				
		22	22.3	21	13.2
		23	22.6	22	12.9
June 24	34.4	24	22.1	24	11.3
June 26	34.8				
1884.					
				1	16.0
		5	13.3	5	14.8
Apr. 7	26.9	7	14.7	7	14.1
Apr. 9	28.1	10	15.4		
		3	11.7	3	10.0
May 5	23.6	5	12.7	5	9.8
May 7	25.2	6	12.8	8	10.4

St. Louis.		Boonville.		Keokuk.	
Date.	Stage.	Date.	Stage.	Date.	Stage.
1884.					
		8	11.9	8	7.6
June 10	20.6	10	13.0	10	7.9
June 12	21.7	12	13.7		
		23	14.9	23	6.8
June 25	21.2	25	15.1	25	7.1
June 27	21.6				
		14	12.1	14	5.2
July 16	19.0	16	13.5	16	5.0
July 18	20.9				
		28	9.2	28	9.6
Sept. 30	20.5	30	10.2	30	10.3
Oct. 2	22.2				
				9	13.3
		10	7.8	10	13.1
Oct. 12	20.1	12	8.1	12	13.1
Oct. 14	20.4				
1885.					
		6	16.9		
		12	11.5	12	
Mar. 14	21.8	14	9.8	14	11.3
Mar. 16	24.1				
		29	13.2	26	11.2
		30	13.4	29	10.6
May 1	25.2	1	13.5	1	10.1
May 3	26.1				
		27	10.9	27	7.1
May 29	18.5	29	11.8	29	7.0
May 31	20.2				
		13	14.5	13	12.3
June 15	24.1	15	16.1	15	9.5
June 17	27.1	22	18.0		
				10	7.2
		13	13.6	13	6.4
July 15	20.0	15	13.2	15	6.0
July 17	20.6				
		11	10.5	11	6.5
Sept. 13	19.4	13	9.9	13	7.1
Sept. 15	22.2			17	8.4
1886.					
		9	7.4		
Feb. 11	20.6	11	7.6		
Feb. 13	23.2				
		26	13.5	26	12.9
Mar. 28	22.6	28	13.1	28	13.5
Mar. 30	23.2			31	14.3
		17	11.9	17	10.9
Apr. 19	22 6	19	12.4	19	11.5
Apr. 21	23.7	20	12.8		

St. Louis.		Boonville.		Keokuk.	
Date.	Stage.	Date.	Stage.	Date.	Stage.
1886.					
				6	16.0
		9	11.3	9	14.3
May 11	24.9	11	11.7	11	14.0
May 13	27.0	13	12.7		
		25	12.1	25	3.9
June 27	16.2	27	13.1	27	4.1
June 29	20.0	29	13.6	29	4.4
1887.					
		15	10.9	15	10.2
Mar. 17	18.8	17	12.7	16	10.4
Mar. 19	20.1	......	....	17	10.2
		30	15.2	30	5.8
Apr. 1	20.4	1	16.0	1	5.5
Apr. 3	20.6				
1888.					
		24	13.2	24	9.0
Mar. 26	23.2	26	15.9	26	10.0
Mar. 28	25.6	27	16.6	27	10.5
		11	14.4	11	9.8
Apr. 13	22.3	13	15.6	13	11.2
Apr. 15	23.2	......	....	15	11.9
		16	15.6	16	19.6
		20	13.1	20	18.9
May 22	27.6	22	12.6	22	18.5
May 24	28.0				
				29	17.0
		31	16.4	31	15.8
June 2	28.8	2	17.8	2	14.6
June 4	29.4	3	17.9		
		27	17.0	27	9.8
June 29	26.6	29	18.5	29	9.2
July 1	27.2				
		7	16.5	7	9.2
July 9	24.0	9	16.3	9	10.1
July 11	25.5				
1889.					
		28	10.7	28	5.6
May 30	21.8	30	14.5	30	5.6
June 1	24.6	31	15.2		
1890.					
		23	12.2		
		26	11.0	26	12.0
June 28	19.7	28	11.7	28	12.3
June 30	20.7	......	....	30	12.6
1891.					
		9	6.4	9	10.4
Apr. 11	18.4	11	8.1	11	10.3
Apr. 13	20.0				
		17	14.2	17	10.2
		18	14.3	18	10.3
Apr. 19	22.4	19	14.1	19	10.2
Apr. 21	22.5				

St. Louis.		Boonville.		Keokuk.	
Date.	Stage.	Date.	Stage.	Date.	Stage.
1891.					
		21	13.5	21	10.4
Apr. 23	22.6	23	14.1	22	10.6
Apr. 25	23.4			23	10.4

MEMPHIS, TENN.

The danger line at Memphis is at 33 feet.

The high water of April 4, 1890, was 35.6 feet.

The distance to Cairo is 230 miles: the difference in level of the zeros of gauges is 86.9 feet.

The corresponding stages at Memphis and at Cairo three days preceding are given in table below, with other stages.

HELENA, ARK.

The danger line at Helena, Ark., is at 37 feet. The highest water April 30, 1886, was 48.1 feet.

The distance from Helena to Cairo is 306.5 miles; the difference in level of the zeros of the gauges is 128.9 feet.

The corresponding stages at Helena and at Cairo four days before are given below.

A great deal of water is added to the Mississippi just above Helena by the St. Francis. When the stages at Cairo are high, above 45 feet, the St. Francis bottoms become flooded. The water runs into the bottoms at a 36-foot stage on the Helena gauge and at 29 feet on the Memphis gauge. This water comes into the bottoms all the way from Cape Girardeau down; it all returns to the Mississippi River through the St. Francis River.

The drainage area of the St. Francis River is about 9,700 square miles.

The filling of the bottoms exercises a retarding influence on the time of occurrence of wave crests at Helena. For stages of the river at Cairo greater than 45 feet the average time of crest at Helena after the occurrence of a crest at Cairo is fourteen days, sometimes as short as nine days, and sometimes as long as twenty-four days.

In the average of cases there is a rise of 2 feet at Helena after the time of a crest at Cairo when the greatest stage at Cairo is 45 feet; when the Cairo stage is 50 the subsequent rise at Helena is on the average 3.5 feet.

ARKANSAS CITY, ARK.

The danger line at Arkansas City is at 42 feet. The highest water, 47.10 feet, occurred February 27, 1882.

The distance from Arkansas City to Cairo is 438.3 miles: the difference in the level of the zeros of gauges is 174.4 feet.

The corresponding stages of water at Arkansas City and at Cairo five days previous are given below.

The principal tributaries coming into the Mississippi between Cairo and Arkansas City are the Arkansas River, the White River, and the St. Francis.

GREENVILLE, MISS.

The highest water at Greenville, 41.68 feet, occurred February 27, 1882.

The distance from Greenville to Cairo is 478.5 miles; the difference in level of the zeros of the gauges is 182.8 feet.

The corresponding river stages at Greenville and at Cairo six days previous are given below.

VICKSBURG, MISS.

The danger line at Vicksburg is at 41 feet. The highest water, that of 1862, was 51.7 feet.

The distance from Vicksburg to Cairo is 599.3 miles; the difference in level of the zeros of the gauges is 224.8 feet.

The corresponding stages at Vicksburg and at Cairo seven days previous are given below.

The principal tributaries coming into the Mississippi River between Cairo and Vicksburg are the Arkansas, draining 185,670 square miles, and the White, draining 27,500; the Yazoo, draining 13,850 square miles, and the St. Francis, draining 9,700 square miles.

Cairo.	Memphis, three days after.	Helena, Ark., four days after.	Arkansas City, five days after.	Greenville, six days after.	Vicksburg, seven days after.
12	....	10.7			
13	....	12.4			
14	....	13.8			
15	....	15.4			
16	....	16.7			
17	11.4	18.3			
18	12.3	19.6			
19	13.1	20.4			
20	14.1	21.0	23.0		
21	14.9	21.7	23.7	18.8	
22	15.7	22.4	24.8	20.3	
23	16.5	23.2	25.7	21.4	21.7
24	17.4	24.5	26.7	22.8	23.4
25	18.3	25.7	27.7	24.2	25.4
26	19.0	26.9	28.6	25.4	27.2
27	19.9	28.2	29.6	26.7	29.3
28	20.8	29.3	30.4	28.0	30.6
29	21.7	30.5	31.5	29.0	31.5
30	22.5	31.5	32.5	29.7	32.4
31	23.3	32.4	33.5	30.4	33.3
32	24.0	33.4	34.5	31.3	34.4
33	25.0	34.4	35.5	32.3	35.3
34	25.7	35.3	36.5	33.3	36.3
35	26.7	36.2	37.5	34.2	37.3
36	27.6	37.1	38.3	35.3	38.2
37	28.4	38.0	39.2	36.3	39.1
38	29.2	38.8	40.2	37.3	40.0
39	30.0	39.6	40.8	38.3	40.7
40	30.7	40.4	41.5	38.7	41.5
41	31.4	41.1	42.2	39.4	42.4
42	32.1	41.7	42.7	40.0	43.3
43	32.6	42.1	43.4	40.1	44.2
44	33.0	42.4	43.8	40.2	44.9
45	33.4	42.6	44.3	40.3	45.6
46	33.7	42.8	44.7	40.4	46.3
47	33.9	43.1	45.2	40.5	47.0
48	34.1	43.3	45.7	40.6	47.7
49	34.3	43.7	46.2	40.7	48.3
50	34.4	44.0	46.6	40.8	48.6
51	34.5	44.3	....	40.9	48.8
52	34.6	44.6	....	41.0	49.0

The best method of finding a coming stage of water at Vicksburg is by means of the rise in the Ohio at Cairo and the rise in the Arkansas at Little Rock.

When the river has been rising for seven days at Cairo and has reached a crest, the rise in the next seven days at Vicksburg will be equal to the seven-day rise preceding at Cairo multiplied by the mean of stage at Cairo on day of crest and seven days before, plus one-third of the five-day rise at Little Rock (or minus in case of a fall) multiplied by the mean stage of water at Little Rock on the day of the Cairo crest and five days before; the sum divided by the Vicksburg stage on the day of the crest and multiplied by a factor as follows, dependent on the Vicksburg stage:

Vicksburg stage, day of Cairo crest.	Factor.	Vicksburg stage, day of Cairo crest.	Factor.
23	0.800	35	0.460
24	0.777		
25	0.765	36	0.420
		37	0.370
26	0.752	38	0.330
27	0.738	39	0.294
28	0.726	40	0.252
29	0.714		
30	0.690	41	0.210
		42	0.170
31	0.650	43	0.130
32	0.612	44	0.090
33	0.560	45	0.090
34	0.510		

In the following table the principal rises at Vicksburg since 1872 are shown, and the rises as computed by the first rule and the differences between the observed and computed.

The second part of table contains the rises computed by the same rule, taking the day of a crest at Little Rock as the starting point. In these cases the rule strictly considered does not apply in all of the cases because there is often a fall instead of a rise preceding at Cairo. None of the rises in the second part were used in deriving the rule, so that the close agreement of the computed and observed rises is a tolerably satisfactory check on the usefulness of the rule in computing the stages.

OBSERVED AND COMPUTED RISES AT VICKSBURG, FROM THE RIVER STAGES AT CAIRO AND LITTLE ROCK.

VICKSBURG.—PART I.

Date.	Observed stage.	Rise in seven days.	Additional rise to crest.	Computed rise.	Residuals Com.-Obs.
1872.					
Apr. 19	36.0	2.8	0.7 in 6 days......	2.1	—0.7
1873.					
Feb. 26	36.7	2.1	0.9 in 6 days......	1.7	—0.4
Apr. 12	36.0	2.9	....	3.0	0.1
May 17	39.3	0.7	0.6 in 6 days......	1.4	0.7
Dec. 18	30.3	4.8	0.4 in 3 days......	4.3	—0.5
1874.					
Jan. 17	21.3	9.9	0.4 in 2 days......	12.1	2.2
Feb. 2	31.5	4.1	0.2 in 1 day......	4.0	—0.1
1875.					
Jan. 8	19.6	5.5	....	6.5	1.0
May 7	40.4	0.6	....	2.1	1.5
Dec. 2	18.0	7.0	....	8.0	1.0

OBSERVED AND COMPUTED RISES AT VICKSBURG, ETC.—Continued.

VICKSBURG—PART I—Continued.

Date.	Observed stage.	Rise in seven days.	Additional rise to crest.	Computed rise.	Residuals Com.-Obs.
1876.					
Jan. 8	33.1	5.1	0.2 in 2 days	4.8	—0.3
May 14	44.8	—0.2		0.6	0.8
June 19	38.6	0.0	0.1 in 1 day	1.5	1.5
1877.					
Jan. 28	29.4	6.5	0.4 in 2 days	5.2	—1.3
Dec. 4	21.7	4.8			
1878.					
Jan. 4	27.7	5.3		4.1	—1.2
Feb. 5	30.4	3.2		3.5	0.3
Mar. 17	40.2	0.8		1.0	0.2
Apr. 29	36.7	3.6		3.7	0.1
1879.					
Jan. 26	32.1	5.3		5.4	0.1
Dec. 17	21.9	8.1	0.4 in 2 days	9.4	1.3
1880.					
Jan. 2	31.7	4.5		5.4	0.9
Feb. 24	36.0	3.2		4.3	1.1
July 9	28.5	5.4	0.4 in 3 days	6.1	0.7
1881.					
Jan. 28	25.2	7.8		8.3	0.5
Mar. 25	40.6	0.6	0.1 in 5 days	1.4	0.8
Apr. 20	40.9	0.2		1.0	0.8
June 22	26.0	5.2	0.3 in 2 days	6.0	0.8
1882.					
Feb. 26	44.5	0.1		0.6	0.5
1883.					
Jan. 30	22.6	8.4	2.9 in 7 days	10.6	2.2
Feb. 27	42.0	0.6	0.5 in 8 days	0.2	—0.4
Nov. 30	23.2	6.3	0.2 in 1 day	6.1	—0.2
1884.					
Jan. 3	28.7	7.3	0.2 in 1 day	8.3	1.0
Feb. 15	40.7	3.1	(?)	2.1	—1.0
Feb. 22	43.8	1.1	(?)	0.2	—0.9
Mar. 23	48.9	0.1		0.5	0.4
Mar. 30	48.3	— 1.5		0.2	1.7
1885.					
Apr. 14	30.2	3.8	1.4 in 7 days	3.8	0.0
Apr. 28	35.4	4.6	0.9 in 5 days	4.3	—0.3
Nov. 14	15.1	7.8	0.3 in 1 day	8.7	0.9
Dec. 22	13.5	6.5	0.1 in 1 day	9.0	2.5
1886.					
Apr. 19	41.2	1.6	1.4 in 11 days	0.5	—1.1
May 17	42.9	— 0.6		1.1	1.7
Nov. 30	8.5	11.8	0.2 in 1 day	(?)	
Dec. 27	7.1	9.8	0.5 in 2 days	(?)	
1887.					
Mar. 9	43.2	0.8	0.7 in 10 days	0.3	—0.5
May 2	29.9	6.5	1.8 in 6 days	7.4	0.9
1888.					
Feb. 28	23.4	5.7	0.5 in 4 days	4.8	—0.9
Apr. 3	35.6	4.2		5.2	1.0
Sept. 1	19.0	5.9	0.03 in 1 day	5.5	—0.4
Nov. 4	11.0	7.6		9.6	2.0
Nov. 17	21.3	7.6		10.2	2.6

OBSERVED AND COMPUTED RISES AT VICKSBURG, ETC.—Continued.

VICKSBURG—PART I—Continued.

Date.	Observed stage.	Rise in seven days.	Additional rise to crest.	Computed rise.	Residuals Com.-Obs.
1889.					
Jan. 22	29.5	4.3	....	2.7	—1.6
Feb. 26	22.6	9.2	1.8 in 6 days......	13.0	3.8
Mar. 26	25.9	4.0	0.4 in 2 days......	4.0	0.0
June 24	29.8	4.3	0.3 in 2 days......	5.7	1.4
1890.					
Jan. 20	34.3	5.3	....	5.4	0.1
Feb. 17	45.2	0.6	....	0.3	—0.3
Mar. 12	47.4	0.6	(?)	0.2	—0.4
Apr. 3	46.6	0.9	1.6 in 15 days.....	0.2	—0.7
May 29	42.0	— 1.2	....	0.5	1.7
1891.					
Mar. 4	44.4	1.9	1.5 in 10 days.....	0.2	—1.7
Apr. 6	48.0	— 0.2	....	0.2	0.4
Apr. 23	47.3	0.1			

VICKSBURG—PART II.

1872.					
May 20	25.0	6.2	1.6 in 5 days	4.5	—1.7
1873.					
May 22	39.8	0.8	....	—1.0	—1.8
Dec. 13	22.8	9.5	3.2 in 8 days	8.6	—0.9
1874.					
Feb. 26	32.6	6.2	1.9 in 7 days	8.2	2.0
1875.					
May 5	40.5	0.3	0.2 in 2 days	2.6	2.3
Aug. 5	39.2	1.0	0.6 in 4 days	2.0	1.0
1876.					
Jan. 31	38.7	1.7	1.0 in 7 days	2.4	0.7
Mar. 28	41.2	1.2	0.8 in 7 days	1.4	0.2
Apr. 5	42.5	0.8	0.5 in 3 days	0.4	—0.4
1877.					
May 24	41.1	— 0.3	....	—0.2	0.1
June 11	37.2	2.2	0.8 in 7 days	2.0	—0.2
1878.					
Feb. 25	35.4	2.8	1.6 in 7 days	1.6	—1.2
Apr. 27	34.8	5.0	1.0 in 6 days	5.6	0.6
May 28	37.8	1.2	0.6 in 1 day	1.9	0.7
1882.					
Feb. 25	44.4	0.2	....	0.7	0.5
May 12	41.7	— 0.2	....	1.4	1.6
1883.					
Feb. 19	38.8	3.0	....	0.8	2.2
May 24	38.0	0.2	0.7 in 7 days	2.0	1.8
June 6	38.8	0.2	....	0.3	0.1
June 14	39.0	0.3	0.4 in 5 days	1.6	1.3
1884.					
Feb. 11	36.7	5.8	1.8 in 7 days	6.0	0.2
1885.					
Jan. 1	17.2	17.0			
May 23	33.8	— 4.4	....	—0.7	3.7
July 10	30.8	— 2.9	....	—0.5	2.4
1889.					
Jan. 20	27.2	6.2	0.4 in 2 days	5.3	—0.9
Mar. 28	25.6	4.7	....	4.4	—0.3

OBSERVED AND COMPUTED RISES AT VICKSBURG, ETC.—Continued.

VICKSBURG—PART II—Continued.

Date.	Observed stage.	Rise in seven days.	Additional rise to crest.	Computed rise.	Residuals Com.-Obs.
1890.					
Mar. 14	47.8	— 0.7	....	0.2	0.9
Apr. 19	48.6	0.4	....	—0.6	—1.0
Apr. 30	48.7	— 0.9	....	0.3	1.2
Nov. 21	17.6	8.1	0.9 in 2 days	7.6	—0.5
Dec. 30	10.7	9.0	10.0 in 7 days	9.8	0.8
1891.					
Jan. 13	29.7	3.9	....	3.0	—0.9
Feb. 4	29.0	7.6	3.6 in 7 days	7.4	—0.2
Feb. 27	43.0	1.8	2.0 in 7 days	0.4	—1.4
Apr. 3	48.1	— 0.1	....	0.1	0.2

Another rule used for Vicksburg, but not as good as that given above is, that the rise in seven days at Vicksburg after a crest at Cairo is equal to the preceding seven-day rise at Cairo multiplied by 1.02 plus the five-day rise at Little Rock preceding the Cairo crest, multiplied by 0.37, the whole multiplied by a factor equal to 1,000 divided by 1,000 plus the square of the Vicksburg stage on day of Cairo crest.

With a high stage of water at Vicksburg, when the river at Cairo is falling, it is counterbalanced by a rise in the Arkansas and White rivers. April 16 to 23, 1891, the river at Cairo fell from 42.7 to 37.2; April 23 to 30 the river at Vicksburg rose from 47.3 to 47.4; at Little Rock the river rose April 18 to 23 from 9.5 to 20.9; at Newport the White River rose April 17 to 24 from 12.1 to 21.5. The changes multiplied by stages show the relation between those at Cairo and the sum of those at Little Rock and Newport when the river remains constant at Vicksburg to be as 240 to 303.

In the above instance the stage at Helena was falling and on day of Vicksburg crest was 40.6, having fallen from 44.7, the highest.

The most important rises at Vicksburg and the preceding stages at Cairo, Little Rock, and Newport, or Jacksonport on the White River are given below.

Vicksburg.		Cairo.		Little Rock.		Jacksonport.	
Date.	Stage	Date.	Stage	Date.	Stage.	Date.	Stage.
1872.							
		12	33.6	14	12.2	12	10.5
						13	10.2
Apr. 19	36.0	19	39.2	19	7.8	19	10.2
Apr. 26	38.8						
May 2	39.5						
1873.							
						20	25.4
		19	36.9	21	10.7	21	25.7
Feb. 26	36.7	26	41.6	26	7.5	26	17.4
Mar. 5	38.8						
Mar. 11	39.7						
		5	35.7	7	4.7	6	4.2
				11	21.5		
Apr. 12	36.0	12	40.6	12	22.6	12	29.9
Apr. 19	38.9	......	......	......	....	13	30.0

Vicksburg.		Cairo.		Little Rock.		Jacksonport.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1873.							
						9	20.5
		10	33.4	12	9.1	11	20.0
May 17	39.3	17	38.8	17	8.5	17	16.5
May 24	40.0			22	18.0		
May 30	40.6						
						12	23.4
		11	26.2	13	18.9	14	23.8
Dec. 18	30.3	18	33.5	18	13.2	18	20.2
Dec. 25	35.1						
Dec. 28	35.5						
1874.							
		10	17.7	12	2.9	10	3.2
Jan. 17	21.3	17	31.0	17	2.3	17	2.1
Jan. 24	31.2						
Jan. 26	31.6						
						27	15.2
		26	25.3	28	13.5	29	16.0
Feb. 2	31.5	2	33.0	2	9.8	2	15.0
Feb. 9	35.6						
Feb. 10	35.8						
1875.							
				3	8.0	1	11.2
		1	17.6	4	11.0	2	11.0
Jan. 8	19.6	8	24.6	8	7.6	8	6.8
Jan. 15	25.1						
				2	12.5	1	9.9
		1	28.7	5	21.0	6	26.8
May 7	40.4	7	37.6	7	18.3	7	26.1
May 14	41.0						
		25	15.0			26	4.1
				27	0.5	27	3.5
Dec. 2	18.0	2	23.0	2	1.2	2	2.8
Dec. 9	25.0						
1876.							
						2	2.6
		1	30.7	3	2.9	7	9.2
Jan. 8	33.1	8	39.0	8	4.0	8	8.2
Jan. 15	38.2						
Jan. 17	38.5						
				9	14.0	8	25.1
		7	35.0	13	18.3	9	26.3
May 14	44.8	14	42.2	14	17.5	14	22.5
May 21	44.7						
		12	26.1	14	6.0	13	9.3
June 19	38.6	19	32.6	19	11.8	19	14.0
June 26	38.6			20	12.0		
June 27	38.7						
1877.							
		21	30.8	23	2.0	22	1.0
Jan. 28	29.4	28	37.0	28	1.7	28	0.8
Feb. 4	35.9						
Feb. 6	36.3						

Vicksburg.		Cairo.		Little Rock.		Jacksonport.	
Date.	Stage	Date.	Stage	Date.	Stage.	Date.	Stage.
1877.							
		27	16.3	27	12.0		
Dec. 4	21.7	4	23.6	4	8.2		
Dec. 11	26.5			9	10.8		
1878.							
		28	19.9	30	17.0		
Jan. 4	27.7	4	27.0	4	15.8		
Jan. 11	33.0						
		29	21.8	31	11.3		
Feb. 5	30.4	5	27.8	5	11.5		
Feb. 12	33.6			6	11.7		
		10	30.5	12	15.0		
Mar. 17	40.2	17	35.7	17	11.0		
Mar. 24	41.0						
				24	12.9		
		22	26.5	27	21.6		
Apr. 29	36.7	29	37.0	29	19.4		
May 6	40.3						
1879.							
		19	26.5	21	9.5	20	7.8
Jan. 26	32.1	26	36.0	26	5.8	26	6.8
Feb. 2	37.4			3	16.6		
1879.							
				12	1.5	11	6.1
		10	20.0	15	5.5	14	7.2
Dec. 17	21.9	17	30.0	17	3.8	17	6.7
Dec. 24	30.0						
Dec. 26	30.4						
1880.							
				28	5.5	27	10.3
		26	28.6	1	5.3	30	11.4
Jan. 2	31.7	2	37.2	2	4.9	2	10.0
Jan. 9	36.2						
		17	35.7			18	20.7
				19	10.8	19	20.8
Feb. 24	36.0	24	43.4	24	6.5	24	17.1
Mar. 2	39.2						
		2	25.9	4	3.2	3	2.5
July 9	28.5	9	34.1	9	6.0	9	5.4
July 16	33.9			15	7.6	13	6.4
July 19	34.3						
						6	5.7
		5	18.1	7	3.4	8	6.4
Dec. 12		12	31.5	12	2.5	12	4.2
1881.							
						22	13.5
		21	22.3	23	5.5	24	14.5
Jan. 28	25.2	28	32.6	28	3.5	28	12.0
Feb. 4	33.0						
		18	32.6	20	8.2	19	9.8
Mar. 25	40.6	25	39.6	25	9.3	25	9.5
Apr. 1	41.2					27	10.2
Apr. 6	41.3						
		14	41.0	15	7.3	14	6.8
				16	7.5		
Apr. 20	40.9	20	45.8	20	5.3	20	8.2
Apr. 27	41.1					26	11.4

Vicksburg.		Cairo.		Little Rock.		Jacksonport.	
Date.	Stage	Date.	Stage	Date.	Stage.	Date.	Stage.
1881.							
		15	23.1	17	4.7	16	8.7
						18	9.0
June 22	26.0	22	30.8	22	4.5	22	8.6
June 29	31.2						
1882.							
				21	22.0	20	28.5
		19	45.8	25	25.7	23	30.9
Feb. 26	44.5	26	51.9	26	24.7	26	28.5
Mar. 5	44.6						
1883.							
		23	18.9	25	5.8	24	5.2
Jan. 30	22.6	30	30.7	30	11.0	30	8.0
Feb. 6	31.0			31	11.4		
Feb. 14	34.6						
						19	32.0
		20	51.4	22	23.9	21	30.6
Feb. 27	42.0	27	52.2	27	25.1	27	26.9
Mar. 6	42.7						
Mar. 14	43.1						
						24	25.4
		23	20.7	25	11.7	25	27.0
Nov. 30	23.2	30	28.1	30	10.5	30	21.0
Dec. 7	29.5						
Dec. 8	29.7						
1884.							
						28	10.0
		27	24.0	29	7.8	1	9.2
Jan. 3	28.7	3	35.3	3	7.6	3	8.7
Jan. 10	36.0						
Jan. 11	36.2						
		8	42.3	10	19.6	9	22.0
Feb. 15	40.7	15	49.0	15	30.6	15	32.8
Feb. 22	43.8						
		15	49.0			15	32.8
				17	29.7	16	31.5
Feb. 22	43.8	22	51.8	22	22.3	22	29.2
Feb. 29	44.9						
						15	18.0
		16	41.1	18	10.2	17	16.0
Mar. 23	48.9	23	47.2	23	9.5	23	11.6
Mar. 25	49.0						
Mar. 30	48.2						
		23	47.2	25	10.2	24	10.8
Mar. 30	48.2	30	48.6	30	13.0	30	15.4
Apr. 6	46.8					31	15.9
1885.							
		7	24.8	9	16.4	8	13.9
				10	16.7	9	14.4
Apr. 14	30.2	14	31.5	14	12.9	14	9.8
Apr. 21	34.0						
		21	31.0	23	10.6	22	6.5
				25	27.5		
Apr. 28	35.4	28	38.2	28	28.6	28	25.6
May 5	40.0						
May 10	40.9						

Vicksburg.		Cairo.		Little Rock.		Newport.	
Date.	Stage.	Date.	Stage.	Date.	Stage.	Date.	Stage.
1885.							
		[illegible]	19.0	9	5.8	8	2.4
						11	2.7
Nov. 14	15.1	14	26.5	11	5.3	14	2.5
Nov. 21	22.9						
Nov. 22	23.2						
		15	17.6	17	4.6	16	2.0
Dec. 22	13.5	22	24.8	22	4.5	22	2.0
Dec. 29	20.0						
Dec. 30	20.1						
1886.							
		12	49.3	14	12.5	13	19.8
Apr. 19	41.2	19	51.0	19	16.1	19	20.6
Apr. 26	42.8						
May 7	44.2						
				12	7.2	11	23.6
		10	29.4	16	9.9	12	24.0
May 17	42.9	17	39.8	17	9.2	17	17.4
May 24	42.3						
		23	7.4	25	9.9	24	5.7
Nov. 30	8.5	30	23.8	30	6.2	30	3.7
Dec. 7	20.3						
Dec. 8	20.5						
1887.							
		20	10.3	23	3.5	21	1.8
Dec. 27	7.1	27	21.1	27	4.4	27	2.7
Jan. 3	16.9			28	4.6	28	3.0
Jan. 5	17.4						
		2	47.0	4	6.0	3	10.3
Mar. 9	43.2	9	48.5	9	12.5	9	19.8
Mar. 16	44.0					10	20.2
Mar. 26	44.7						
		25	30.3	27	4.5	26	3.5
May 2	29.9	2	39.4	2	5.9	2	3.7
May 9	36.4			6	17.6	8	24.5
May 15	38.2						
1888.							
		21	23.6	23	5.8	22	3.5
						27	5.2
Feb. 28	23.4	28	29.0	28	6.4	28	5.0
Mar. 7	29.1			9	12.8		
Mar. 11	29.6						
		27	33.2	29	14.4	28	18.0
						29	18.6
Apr. 3	35.6	3	45.2	3	9.4	3	15.8
Apr. 10	39.8						
		25	18.2	27	4.6	26	2.3
Sept. 1	19.0	1	24.1	1	7.0	1	12.6
Sept. 8	24.9			3	14.0	3	18.0
Sept. 9	24.9						
		28	15.4	30	3.4	29	1.9
Nov. 4	11.0	4	22.4	4	3.4	4	1.5
Nov. 11	18.6						

Vicksburg.		Cairo.		Little Rock.		Newport.	
Date.	Stage	Date.	Stage	Date.	Stage.	Date.	Stage.
1888.							
						11	14.0
		10	20.9	12	6.3	14	17.0
Nov. 17	21.3	17	31.2	17	8.0	17	12.2
Nov. 24	28.9			21	9.7		
1889.							
				17	21.0	16	16.7
		15	26.1	19	23.0	19	22.7
Jan. 22	29.5	22	30.6	22	19.9	22	22.0
Jan. 29	33.8						
						20	9.5
		19	18.4	21	8.6	22	11.0
Feb. 26	22.6	26	32.8	26	8.6	26	9.2
Mar. 5	31.8			5	20.8		
Mar. 11	33.6						
		19	21.5	21	10.9	20	14.6
Mar. 26	25.9	26	25.3	26	20.8	26	22.4
Apr. 2	29.9			28	23.0	27	23.0
Apr. 4	30.3						
		17	27.4			18	4.1
				19	12.0	22	5.7
June 24	29.8	24	34.5	24	17.2	24	5.4
July 1	34.1			25	17.6		
July 3	34.4						
1890.							
				15	10.3	11	27.9
		13	34.4	18	17.3	14	26.5
Jan. 20	34.3	20	43.7	20	14.7	20	25.7
Jan. 27	39.6						
						5	27.8
		10	36.9	12	15.9	11	26.6
Feb. 17	45.2	17	41.8	17	15.2	17	23.0
Feb. 24	45.8			18	15.3		
		5	46.0	7	13.2	6	24.4
Mar. 12	47.4	12	48.8	12	16.1	12	24.4
Mar. 15	48.0			14	22.3	14	33.0
Mar. 19	47.4						
		27	46.8	29	14.8	28	26.2
Apr. 3	46.6	3	48.7	3	15.1	3	24.6
Apr. 10	47.5			6	20.6	6	30.1
Apr. 25	49.1						
		22	29.5	24	13.2	23	19.4
				25	13.7		
May 29	42.0	29	34.0	29	9.6	29	16.4
June 6	40.8					6	18.0
1891.							
		25	44.3			26	20.8
				27	14.5	27	20.5
Mar. 4	44.4	4	46.2	4	10.4	4	17.4
Mar. 11	46.3						
Mar. 21	47.8						
Apr. 2	48.1						

Vicksburg.		Cairo.		Little Rock.		Newport.	
Date.	Stage	Date.	Stage	Date.	Stage.	Date.	Stage.
1891.		30	41.9	1	12.9	31	13.9
				3	16.2		
Apr. 6	48.0	6	44.8	6	12.6	6	12.4
Apr. 13	47.8						

The following stages are arranged with reference to the crests at Little Rock.

Vicksburg.		Cairo.		Little Rock.		Jacksonport.	
Date.	Stage	Date.	Stage	Date.	Stage.	Date.	Stage.
1872.							
		13	15.3	15	18.8	14	9.9
May 20	25.0	20	20.6	20	26.0	20	16.8
May 27	31.2					23	21.7
1873.							
						9	20.5
May 15	39.2	15	37.7	17	8.5	16	17.1
May 22	39.8	22	32.0	22	18.0	22	14.9
May 29	40.6						
Dec. 6	13.0	6	19.2	8	9.1	7	13.3
Dec. 13	22.8	13	27.7	13	18.9	13	23.6
Dec. 20	32.3					14	23.8
1874.							
Feb. 19	30.8	19	27.0	21	6.4	20	10.5
						25	26.8
Feb. 26	32.6	26	39.8	26	20.0	26	26.7
Mar. 5	38.8						
1875.							
Apr. 28	42.5	28	24.4	30	9.7	29	10.0
May 5	40.5	5	36.1	5	21.0	5	26.5
May 12	40.8					6	26.8
July 29	38.2	29	40.0	31	9.4	30	9.8
Aug. 5	39.2	5	44.8	5	21.8	4	23.4
Aug. 12	40.2					5	23.4
1876.							
Jan. 24	36.5	24	36.2	26	15.2	25	19.8
Jan. 31	38.7	31	43.0	31	22.5	31	31.6
Feb. 7	40.4						
Mar. 21	39.5	21	39.1	23	13.5	22	26.2
Mar. 28	41.2	28	44.2	28	22.5	28	28.0
Apr. 4	42.4					29	28.2
Mar. 29	41.4	29	44.7	31	18.4	30	27.6
Apr. 5	42.5	5	46.2	5	23.1	4	28.3
Apr. 12	43.3					5	28.1
1877.							
						18	18.8
May 17	41.5	17	33.2	19	17.4	20	20.6
May 24	41.1	24	30.7	24	23.0	24	17.4
May 31	40.8						
June 4	40.2	4	22.1	6	11.6	5	7.5
June 11	37.2	11	26.3	11	26.7	11	25.0
June 18	39.4					13	26.4

Vicksburg.		Cairo.		Little Rock.		Jacksonport.	
Date.	Stage	Date.	Stage	Date.	Stage.	Date.	Stage.
1878.							
Feb. 18	33.1	18	29.2	20	9.0		
Feb. 25	35.4	25	31.2	25	21.2		
Mar. 4	38.2						
Apr. 20	30.3	20	22.9	22	9.7		
Apr. 27	34.8	27	35.7	27	21.6		
May 4	39.8						
May 21	39.7	21	26.7	23	8.7		
May 28	37.8	28	31.5	28	24.3		
June 4	39.0					12	15.2
1882.							
Feb. 18	44.1	18	45.6	20	20.9	19	28.7
Feb. 25	44.4	25	51.8	25	25.7	25	30.1
Mar. 4	44.6						
May 6	42.0	5	32.1	7	7.2	6	6.0
						11	31.2
May 12	41.7	12	39.1	12	24.7	12	31.0
May 19	41.5						
1883.							
						9	17.6
Feb. 12	33.1	12	44.9	14	17.5	13	20.7
Feb. 19	38.8	19	45.8	19	25.8	19	32.0
Feb. 26	41.8						
						18	9.0
May 17	41.1	17	23.7	19	6.5	23	22.9
May 24	38.0	24	30.0	24	20.0	24	22.0
May 31	38.2						
						31	15.5
May 30	38.1	30	32.2	1	12.9	2	19.8
June 6	38.8	6	32.0	6	21.3	6	17.6
June 13	39.0						
June 7	38.9	7	31.6	10	17.9	8	16.6
June 14	39.0	14	36.2	14	25.4	14	22.9
June 21	39.3					15	23.0
1884.							
Feb. 4	31.1	4	31.8	6	9.9	5	9.0
Feb. 11	36.7	11	45.8	11	21.1	11	23.1
Feb. 18	42.5					15	32.8
1885.							
Dec. 25	15.9	25	13.2	27	8.4	26	3.5
Jan. 1	17.2	1	26.5	1	26.0	1	30.8
Jan. 8	34.2					2	30.9
May 16	39.6	16	25.6	18	12.3	17	6.3
May 23	33.8	23	21.2	23	22.2	23	5.5
May 30	29.4						
						4	6.8
July 3	33.6	3	25.0	5	13.9	7	15.1
July 10	30.8	10	21.5	10	23.0	10	12.0
July 17	27.9						

Vicksburg.		Cairo.		Little Rock.		Newport.	
Date.	Stage	Date.	Stage	Date.	Stage.	Date.	Stage.
1889.							
						14	16.6
Jan. 13	17.0	13	25.0	15	15.4	19	22.7
Jan. 20	27.2	20	30.0	20	23.0	20	22.7
Jan. 27	33.4						
						22	19.4
Mar. 21	28.6	21	20.8	23	10.2	27	23.0
Mar. 28	25.6	28	24.5	28	23.0	28	23.0
Apr. 4	30.3						
1890.							
Mar. 7	46.5	7	47.2	9	11.0	8	22.9
Mar. 14	47.8	14	48.4	14	22.3	14	33.0
Mar. 21	47.1						
Apr. 12	47.8	12	43.9	14	11.2	13	24.0
Apr. 19	48.6	19	34.5	19	22.3	19	24.2
Apr. 26	49.0						
Apr. 23	48.9	23	33.4	25	15.3	24	22.6
Apr. 30	48.7	30	36.2	30	24.3	30	28.8
May 7	47.8						
Nov. 14	18.0	14	14.7	16	13.5	15	15.7
Nov. 21	17.6	21	22.2	21	19.7	21	23.5
Nov. 28	25.7	25	24.3			22	23.3
				24	5.8		
Dec. 23	13.5	23	9.3	25	6.0	24	5.9
Dec. 30	10.7	30	17.1	30	15.1	30	10.8
						31	11.5
1891.							
Jan. 6	19.7	6	28.5	8	10.0	7	12.5
Jan. 13	29.7	13	32.2	13	15.2	13	14.0
Jan. 20	33.6					18	15.0
Jan. 28	31.1	28	23.0	30	9.3	30	10.8
						3	17.1
Feb. 4	29.0	4	33.0	4	14.1	4	16.9
Feb. 11	36.6						
				20	8.1	21	16.2
Feb. 20	40.9	20	42.2	22	11.8	26	20.8
Feb. 27	43.0	27	45.1	27	14.5	27	20.5
Mar. 6	44.8						
				28	8.5	22	19.4
Mar. 27	47.8	27	42.9	29	9.0	28	16.0
Apr. 3	48.1	3	44.0	3	16.2	3	13.1
Apr. 5	48.0	6	44.8				
Apr. 16	47.6	16	42.7	18	9.5	17	12.1
Apr. 23	47.3	23	37.2	23	20.9	23	18.7
Apr. 30	47.4					26	23.8

Corresponding stages of water at Helena and at Arkansas City, Greenville and Vicksburg, subsequently, are as follows:

Helena.	Arkansas City, one day after.	Greenville, two days after.	Vicksburg, three days after.	Helena.	Arkansas City, one day after.	Greenville, two days after.	Vicksburg, three days after.
13	13.1	....	12.0	33	34.0	30.7	33.7
14	14.2	....	13.3	34	35.0	31.5	34.8
15	15.3	13.7	14.5	35	36.0	32.3	36.0
16	16.4	14.5	15.8	36	37.0	33.2	37.2
17	17.5	15.5	17.2	37	38.0	34.0	38.4
18	18.6	16.6	18.3	38	38.8	34.8	39.6
19	19.7	17.5	19.3	39	40.0	35.8	40.2
20	20.7	18.5	20.1	40	41.0	36.7	40.7
21	21.8	19.5	20.7	41	42.0	37.7	41.3
22	23.1	20.5	21.7	42	42.8	38.6	41.8
23	24.0	21.5	22.7	43	43.7	39.2	42.4
24	25.1	22.4	24.4	44	44.5	39.8	43.3
25	26.0	23.4	25.6	45	45.3	40.4	43.8
26	27.0	24.4	27.1	46	46.2	41.0	44.5
27	28.0	25.3	28.4	47	46.7	41.5	45.2
28	29.0	26.2	29.3	48	46.9	42.0?	45.9?
29	30.3	27.2	30.4	49			
30	31.3	28.2	31.3	50			
31	32.2	28.9	31.8				
32	33.1	29.8	32.7				

For stages of 41 feet or over at Cairo the average time of Vicksburg crest after Cairo crest is seventeen days; in one case only three days, in one case eight days, in the highest case thirty-one days, and one case twenty-nine days. The rise after the Cairo crest at Vicksburg is usually proportional to the time. The whole rise varies in different cases from 0.3 foot to 5.2 feet. The tendency is for the stage of water at Vicksburg to approximate to a certain high crest, 47, 48, or 49 feet, depending on the Cairo stage.

BATON ROUGE, LA.

The corresponding water stages at Baton Rouge and Vicksburg three days before are given below.

The distance between the places is 234.2 miles; the difference in the level of the zeros of the gauges is 46 feet.

Vicksburg.	Baton Rouge three days after.	Vicksburg.	Baton Rouge three days after.
17	11.8 ±1.0	34	25.3
18	12.2	35	25.6 ±1.1
19	12.4		
20	12.6 ±1.7	36	26.0
		37	26.3
21	13.0	38	26.7
22	13.4	39	27.5
23	13.9	40	28.4 ±1.0
24	14.4		
25	14.8	41	29.4
		42	30.4
26	15.4	43	30.9
27	16.0	44	31.7
28	17.0	45	32.6
29	18.2		
30	19.6 ±1.4	46	33.4
		47	34.3
31	21.4	48	35.2 ±0.8
32	23.4	49	36.0
33	24.5	50	

The important tributaries entering the Mississippi between Vicksburg and Baton Rouge are the Red River, draining 97,000 square miles, and the Ouachita, draining 18,560 square miles.

NEW ORLEANS, LA.

The danger-line at New Orleans is at 13 feet. The highest water, 17.1 feet, occurred in March, 1890.

The distance from New Orleans to Vicksburg is 366.2 miles; the difference in level of the zeros of the gauges is 46.8 feet.

The corresponding river stages at New Orleans and at Vicksburg four days previous are as follows:

Vicksburg.	New Orleans, four days after.	Vicksburg.	New Orleans, four days after.
20	6.3	36	11.7
		37	12.1
21	6.6	38	12.4
22	6.8	39	12.7
23	6.9	40	13.1
24	7.2		
25	7.6	41	13.4
		42	13.6
26	7.9	43	14.0
27	8.3	44	14.2
28	8.7	45	14.5
29	9.1		
30	9.5	46	14.7
		47	15.0
31	9.9	48	15.3
32	10.3	49	15.7
33	10.7	50	
34	11.1		
35	11.5		

The rise at New Orleans in four days is, on the average, one-third of the preceding four-day rise at Vicksburg.

The important tributaries coming into the Mississippi between Vicksburg and New Orleans are the Red and Ouachita Rivers.

DARDANELLE, ARK.

The danger-line at Dardanelle, Ark., is at 22 feet.

The distance from Dardanelle to Fort Smith is 95 miles; the difference in level of the zeros of gauges is 74.3 feet.

The corresponding wave-crest water stages at Dardanelle and at Fort Smith one day previous are as follows:

Fort Smith.	Dardanelle one day after.		Fort Smith.	Dardanelle one day after.	
6	6.4	±0.7	15	14.4	±0.7
7	7.1				
8	8.0		16	15.4	
9	8.9		17	16.3	
10	9.7	±0.6	18	17.3	
			19	18.3	
11	10.4		20	19.4	±0.0
12	11.3				
13	12.3		21	20.4?	
14	13.3		22		

There are no important tributaries coming into the Arkansas between Fort Smith and Dardenelle.

LITTLE ROCK, ARK.

The danger-line at Little Rock, Ark., is at 23 feet (Weather Bureau gauge). The high water of 1844 was 31 feet.

The distance from Little Rock to Fort Smith is 173 miles; the difference in the level of the zeros of the gauges is 148.9 feet.

The corresponding wave-crest water stages at Little Rock and at Fort Smith two days before are as follows: These crests apply to the stages as given by the engineer gauge, which is about 1 mile above the Weather Bureau gauge and its zero 1.22 feet lower than the zero of the Weather Bureau gauge. The slope of river being about 0.9 foot per mile, the engineer gauge reads 0.3 foot higher than Weather Bureau gauge.

Fort Smith.	Little Rock two days after.		Fort Smith.	Little Rock two days after.
12	14.5	±1.2	21	23.8
13	15.5		22	24.7
14	16.6		23	25.5
15	17.7	±1.2	24	26.4
			25	27.3
16	18.8			
17	20.2		26	28.1
18	21.0		27	28.7
19	22.0		28	29.6
20	22.8	±0.7	29	30.3
			30	31.0

The rise at Little Rock in four days is on the average the same as the rise at Fort Smith in the same time.

There are no important tributaries coming into the Arkansas between Fort Smith and Little Rock.

In the following table are given the corresponding stages at Fort Smith and Little Rock during the principal rises since 1879.

Fort Smith.		Little Rock.	
Date.	Stage.	Date.	Stage.
1879.		1879.	
Apr. 24	4.3	Apr. 27	2.5
Apr. 25	6.2	Apr. 29	5.5
Apr. 27	12.2	May 1	10.4
1880.		1880.	
Apr. 3	4.9	Apr. 6	5.0
Apr. 5	12.9	Apr. 8	10.7
1881.		1881.	
Feb. 7	7.5	Feb. 7	6.0
Feb. 9	14.4	Feb. 12	15.6
May 21	10.8	May 23	10.6
May 23	12.8	May 25	12.4
May 25	15.8	May 27	15.6
June 30	10.2	July 1	8.9
July 2	12.8	July 5	12.2
Oct. 5	11.2	Oct. 7	11.0
Oct. 7	15.2	Oct. 9	14.4
Oct. 22	7.9	Oct. 25	6.8
Oct. 24	12.2	Oct. 27	11.9
Nov. 11	6.5	Nov. 11	5.0
Nov. 16	13.7	Nov. 18	*13.7
Dec. 21	9.5	Dec. 24	9.5
Dec. 23	12.3	Dec. 26	13.0
1882.		1882.	
Feb. 19	13.9	Feb. 17	17.9
Feb. 21	18.2	Feb. 22	24.0
Feb. 23	21.8	Feb. 25	25.7
Mar. 9	10.0	Mar. 9	15.3
Mar. 11	12.0	Mar. 11	15.0
Mar. 13	12.6	Mar. 13	*16.1
Mar. 19	9.6	Mar. 23	12.0
Mar. 21	12.1	Mar. 25	13.9
May 6	5.7	May 7	7.2
May 8	10.0	May 9	13.0
May 10	16.2	May 12	24.7
May 28	11.1	May 31	14.4
May 30	16.2	June 1	17.6
June 1	17.2	June 3	19.6
June 17	12.3	June 21	13.8
June 19	12.6	June 22	14.2
June 21	14.2	June 23	15.0
Oct. 16	7.0	Oct. 17	9.0
Oct. 18	12.2	Oct. 21	13.6

Fort Smith.		Little Rock.	
Date.	Stage.	Date.	Stage.
1883.		1883.	
Feb. 13	8.8	Feb. 14	17.5
Feb. 15	17.0	Feb. 16	20.0
Feb. 17	21.8	Feb. 19	25.8
Feb. 23	11.9	Feb. 25	20.4
Feb. 24	17.6	Feb. 26	23.6
Feb. 26	21.6	Feb. 28	25.2
May 17	4.1	May 20	6.5
May 20	10.7	May 22	11.1
May 22	17.5	May 24	20.0
May 29	7.4	May 31	10.7
May 31	15.0	June 2	17.0
June 2	13.0	June 4	18.1
June 4	17.2	June 6	21.3
June 9	14.1	June 10	17.9
June 11	22.8	June 14	25.4
July 16	6.8	July 17	6.7
July 18	16.2	July 21	16.4
Aug. 9	8.2	Aug. 12	9.4
Aug. 11	11.8	Aug. 14	13.6
Oct. 19	7.8	Oct. 19	10.9
Oct. 20	13.0	Oct. 23	15.5
Dec. 6	7.4	Dec. 6	7.4
Dec. 7	15.0	Dec. 7	8.0
		Dec. 9	19.5
1884.		1884.	
Feb. 10	10.5	Feb. 10	19.6
Feb. 12	24.7	Feb. 12	25.6
Feb. 14	27.9	Feb. 15	30.6
May 1	8.6	May 1	15.6
May 2	14.8	May 3	18.6
May 4	23.2	May 6	26.4
June 1	6.8	June 4	10.4
June 3	12.0	June 6	14.5
Oct. 3	5.8	Oct. 4	5.5
Oct. 5	12.2	Oct. 6	7.4
		Oct. 8	14.4
Dec. 11	8.8	Dec. 10	7.8
Dec. 12	10.6	Dec. 12	10.3
Dec. 14	15.6	Dec. 16	18.6
1885.		1885.	
Dec. 28	5.1	Dec. 27	8.4
Dec. 30	15.1	Dec. 30	23.4
Jan. 1	18.5	Jan. 1	26.0

*No crest.

Fort Smith.		Little Rock.	
Date.	Stage.	Date.	Stage.
1885.		1885.	
Jan. 15	10.7	Jan. 16	15.4
Jan. 17	11.8	Jan. 18	17.5
Feb. 4	10.3	Feb. 6	12.7
Feb. 6	14.2	Feb. 8	16.9
Feb. 8	15.2	Feb. 10	18.1
Feb. 28	10.8	Feb. 28	14.4
Mar. 2	13.5	Mar. 4	17.8
Mar. 15	10.0	Mar. 15	12.4
Mar. 17	11.1	Mar. 17	14.0
Apr. 3	6.9	Apr. 6	12.5
Apr. 5	12.7	Apr. 10	16.7
Apr. 21	7.2	Apr. 22	9.5
Apr. 22	10.0	Apr. —	------
Apr. 24	27.4	Apr. 25	27.5
Apr. 26	27.9	Apr. 27	28.6
May 17	9.2	May 17	12.1
May 18	12.0	May 20	13.2
May 20	19.2	May 23	22.2
June 25	13.8	June 28	16.9
June 27	17.1	June 30	19.8
July 4	10.2	July 6	13.3
July 5	12.8	July 7	13.3
July 7	20.9	July 10	23.0
July 13	16.8	July 16	20.3
July 15	18.3	July 18	21.1
Sept. 8	5.0		
Sept. 11	15.5	Sept. 11	7.7
Sept. 13	17.5	Sept. 14	18.6
		Sept. 15	19.5
1886.		1886.	
Feb. 10	6.3	Feb. 11	9.9
Feb. 12	13.0	Feb. 14	15.9
Feb. 14	14.9	Feb. 16	17.9
Apr. 15	7.5	Apr. 11	9.5
Apr. 17	10.1	Apr. 15	11.9
Apr. 19	12.9	Apr. 17	12.9
		Apr. 19	16.1
Apr. 27	6.8	Apr. 27	10.2
Apr. 28	10.1	Apr. 30	10.6
Apr. 30	11.5	May 2	13.6
Aug. 5	7.9	Aug. 3	8.4
Aug. 7	10.4	Aug. 8	10.2
Aug. 9	13.7	Aug. 12	15.0
1888.		1888.	
Mar. 2	5.8	Mar. 3	8.2
Mar. 4	8.2	Mar. 6	10.4

Fort Smith.		Little Rock.	
Date.	Stage.	Date.	Stage.
1888.		1888.	
Mar. 6	10.4	Mar. 9	12.8
Apr. 9	5.8	Apr. 9	7.3
Apr. 13	16.0	Apr. 13	15.1
		Apr. 15	19.2
Apr. 28	7.7	Apr. 30	6.7
Apr. 30	16.3	May 3	19.3
May 17	6.0	May 18	8.4
May 19	14.8	May 21	18.6
May 21	17.8	May 23	20.3
May 27	9.5	May 29	12.6
May 28	13.3	May 31	15.8
June 10	6.0	June 11	7.9
June 11	16.3	June 14	18.1
June 23	6.9	June 23	9.2
June 24	11.0	June 27	16.8
June 26	14.3	June 29	18.2
Aug. 30	3.0	Sept. 1	7.0
Sept. 1	13.3	Sept. 3	14.0
Dec. 26	3.4	Dec. 26	7.3
Dec. 28	17.0	Dec. 30	19.8
1889.		1889.	
Jan. 8	5.8	Jan. 8	10.1
Jan. 10	13.3	Jan. 13	17.4
Jan. 15	12.0	Jan. 15	15.4
Jan. 17	17.9	Jan. 19	23.0
Jan. 25	9.0	Jan. 27	15.3
Jan. 26	11.0	Jan. 29	17.3
Mar. 1	8.4	Mar. 1	8.4
Mar. 3	17.3	Mar. 5	20.9
Mar. 22	4.8	Mar. 23	10.2
Mar. 24	18.1	Mar. 24	10.2
Mar. 26	20.0	Mar. 27	22.6
Apr. 21	6.5	Apr. 22	10.0
Apr. 23	13.2	Apr. 25	15.6
May 14	3.8	May 16	7.5
May 15	6.3	May 18	9.8
May 17	12.0	May 20	14.0
May 21	7.6	May 23	10.6
May 23	14.0	May 25	15.8
June 19	6.2	June 21	10.9
June 21	12.7	June 23	15.8
June 23	14.8	June 25	17.6
July 27	3.9	July 28	7.8
July 29	14.3	July 31	19.3

Fort Smith.		Little Rock.	
Date.	Stage.	Date.	Stage.
1890.		1890.	
Jan. 13	2.9	Jan. 14	9.7
Jan. 14	10.0	Jan. 16	14.8
Jan. 16	14.2	Jan. 18	17.3
Feb. 2	5.3	Feb. 5	14.1
Feb. 3	8.8	Feb. 6	14.4
Feb. 5	11.8	Feb. 8	18.1
Feb. 14	9.0	Feb. 15	14.1
Feb. 16	11.8	Feb. 18	15.3
Feb. 25	5.5	Feb. 24	9.8
Feb. 26	9.0	Feb. 27	18.6
Feb. 28	11.3	Mar. 1	19.2
Mar. 11	6.7	Mar. 11	9.6
Mar. 12	21.0	Mar. 14	22.3
Mar. 22	6.6	Mar. 21	13.0
Mar. 24	12.5	Mar. 24	18.4
Apr. 15	6.0	Apr. 15	10.8
Apr. 17	17.1	Apr. 19	22.3
Apr. 24	7.1	Apr. 26	15.2
Apr. 25	12.2	Apr. 27	22.0
Apr. 28	21.0	Apr. 29	24.3
May 12	8.0	May 13	11.5
May 14	11.2	May 16	15.2
Aug. 28	6.6	Aug. 29	8.0
Aug. 30	11.5	Sept. 1	12.3
1890.		1890.	
Sept. 15	2.7	Sept. 20	11.3
Sept. 17	6.4	Sept. 21	13.0
Sept. 19	10.6	Sept. 26	15.6
Oct. 23	6.8	Oct. 25	9.1
Oct. 25	11.2	Oct. 27	12.4
Nov. 16	10.5	Nov. 17	13.4
Nov. 18	15.0	Nov. 19	18.2
Nov. 20	17.1	Nov. 21	19.7
Dec. 25	3.2	Dec. 26	7.8
Dec. 27	12.3	Dec. 28	13.3
		Dec. 30	15.1
1891.		1891.	
Jan. 16	8.0	Jan. 18	12.5
Jan. 18	11.6	Jan. 20	14.2
Feb. 21	3.7	Feb. 23	11.8
Feb. 23	7.8	Feb. 25	11.9
Feb. 25	11.9	Feb. 27	14.5
Mar. 28	8.7	Mar. 30	10.3
Mar. 30	10.5	Apr. 1	12.8
Apr. 1	14.5	Apr. 3	16.2
Apr. 17	6.3	Apr. 19	9.5
Apr. 19	9.2	Apr. 21	10.6
Apr. 21	17.5	Apr. 23	20.9

SHREVEPORT, LA.

The danger line at Shreveport, La., is at 29 feet. The extreme high water of 1849 read 35.9 feet.

The distance from Shreveport to Fulton is 115 miles.

The difference in the level of zeros of gauges is 83.5 feet.

The high water at Fulton, July 17, 1876, was 35.8 feet.

The corresponding high-water crests at Shreveport, and at Fulton two days before, are about the same when the result of general rains.

The principal tributary coming into the Red River between Fulton and Shreveport is the Sulphur Fork.

A stage of 28 feet at Fulton corresponds to 26.8 feet later at Shreveport; 33 at Fulton corresponds to 31.8 at Shreveport.

ALEXANDRIA, LA.

The danger line at Alexandria, La., is at 33 feet. The high water of 1849 was 35.4 feet: that of 1866, 36.5; the highest, 36.85 feet, occurred May 19, 1890.

The distance from Alexandria to Shreveport is 151 miles; the difference in level of the zeros of gauges is 96.8 feet.

The corresponding water stages at Alexandria and at Shreveport at various intervals, from one to eight days, preceding are as follows:

Shreveport.	Alexandria.		Shreveport.	Alexandria.	
6	0.0	±1.6	21	17.6	
7	1.8		22	19.0	
8	3.0		23	20.3	
9	4.1		24	22.0	
10	5.4	±2.0	25	23.5	±2.8
11	6.5		26	25.2	
12	7.8		27	26.8	
13	8.8		28	28.0	
14	9.6		29	29.3	
15	10.4	±2.4	30	30.4	±1.6
16	11.3		31	31.6	
17	12.2		32	32.3	
18	13.1		33	33.0	
19	14.6		34		
20	16.0	±2.0	35	36.8?	

There are no important tributaries coming into the Red River between Shreveport and Alexandria.

The rainfall of 22.3 inches, June 16, 1886, produced a rise of 19 feet in the Red River. The rainfall the same day at Cheneyville, 22 miles south, was 13.3 inches. On the day preceding, June 15, there was 6.3 inches of rainfall at Alexandria. The river discharge in the next ten days was about 0.3 cubic mile. This corresponds to a rainfall of 30 inches over an area of 634 square miles.

COUSHATTA, LA.

The corresponding high waters at Alexandria and at Coushatta, 95 miles above, are very nearly the same at high stages; the difference in level of the zeros of the gauges is 50.2 feet. The danger line is at 26 feet.

MONROE, LA.

The danger line at Monroe, La., is at 40 feet. The highest water, 49.1 feet, occurred in 1874; a stage of 48.9 feet occurred in 1882.

The distance from Monroe to Camden is 121 miles; the difference in level of the zeros of the gauges is 39.6 feet.

The danger line at Camden is at 39 feet.

The corresponding water stages at Monroe and at Camden do not correspond closely enough to be of any value in predicting the stages at Monroe. A stage of 27 feet at Camden may be followed by one of 42 at Monroe, and perhaps by one of no more than 14 feet.

Saline River and Bayou Bartholomew are the most important tributaries entering the Ouachita between Camden and Monroe.

ALBANY, OREGON.*

The danger line at Albany is at 25 feet. The highest water, 36 feet, occurred December 8, 1861; 32.8 feet occurred January 14, 1881.

The distance to Eugene City is 51 miles; the difference in level of the zeros of the gauges is 229.9 feet. The highest water, 22 feet, occurred at Eugene City in 1861.

* No observations now.

The most important tributary coming into the Willamette River between Eugene City and Albany, Oregon, is the McKenzie River.

There is not a sufficient record of water stages at Eugene City and Albany to make a table of corresponding crests at the two places.

PORTLAND, OREGON.

The danger line at Portland, Oregon, is 15 feet above the zero of the river gauge. The high water of June 24, 1876, was 26.2 feet; that of February 6, 1890, was 28.7 feet.

The distance from Portland, Oregon, to Albany, Oregon, is 90 miles.

The corresponding wave-crest water stages at Portland and Albany one or two days before are as follows:

Albany.	Portland, one or two days after.
19	10.0
20	11.3
21	12.6
22	14.0
23	15.1
24	15.9
25	17.1
26	18.1
27	19.1
28	20.2
29	21.2
30	22.5

The high water of June, 1876, at Umatilla, 177 miles above Portland, Oregon, on the Columbia River, was 30 feet.

SACRAMENTO, CAL.

The danger line at Sacramento, Cal., is at 25 feet. The high water of December 12, 1889, was 27 feet.

The distance from Sacramento to Colusa is 73 miles, and from Colusa to Red Bluff 80 miles.

The principal tributary of the Sacramento River between Sacramento and Colusa is the Feather River, on which are situated Marysville, 45 miles farther up, and Oroville, 74 miles.

The corresponding wates stages at Sacramento and at Colusa three days before are as follows:

Colusa.	Sacramento, three days after.	Colusa.	Sacramento, three days after.
12	14.2	21	19.2
13	14.6	22	19.9
14	15.3	23	20.5
15	15.6	24	21.8
		25	23.1
16	16.0		
17	16.6	26	24.3
18	17.3	27	
19	17.9	28	27.0
20	18.5	29	

AUGUSTA, GA.

The danger line at Augusta, Ga., is at 32.6 feet. The highest water, 38.7 feet, occurred September 11, 1888.

The height of zero of gauge above sea-level is 129.9 feet.

The following are the large rises in the Savannah at Augusta, Ga., and the mean rainfalls in the three days preceding at Chattanooga, Knoxville, Atlanta, Augusta, and Charlotte:

Date.	Stage.	Rise.	Rainfall three days previous.		
			Augusta.	Atlanta.	Mean of 5.
1876.	*Feet.*	*Feet.*	*Inches.*	*Inches.*	*Inches.*
Apr. 12	25.6	19.6	----	----	----
1877.					
Mar. 3	22.0	16.0	1.7	----	1.5
Mar. 27	22.8	16.0	1.9	----	1.4
Apr. 10	24.5	16.5	1.8	----	2.2
Apr. 14	29.8	15.8	3.0	----	2.1
Nov. 23	23.5	18.0	3.6	----	3.0
1878.					
Jan. 11	21.5	13.5	1.3	----	1.0
Feb. 23	20.0	14.0	0.4	----	0.4
1879.					
Apr. 17	19.2	12.2	3.2	----	2.4
Oct. 19	23.0	18.3	0.6	2.0	1.3
Dec. 16	30.1	20.6	1.0	3.8	1.9
1880.					
Mar. 17	28.4	20.6	0.4	3.0	1.7
Apr. 5	24.2	15.9	0.7	1.7	2.2
1881.					
Jan. 21	30.5	23.2	4.4	4.0	2.7
Feb. 11	29.5	22.7	2.5	4.7	2.3
Mar. 18	32.2	23.8	3.9	6.6	3.0
Dec. 28	23.0	14.0	1.5	2.2	1.0
1882.					
Feb. 10	27.0	13.8	1.0	2.0	1.5
Mar. 2	24.7	15.9	1.2	3.0	1.7
Sept. 12	29.3	21.5	1.4	2.7	2.3
Dec. 23	21.5	16.0	2.4	1.6	1.7
1883.					
Jan. 22	30.6	20.4	1.3	4.4	2.5
Apr. 11	26.8	16.5	3.5	3.2	2.2
Apr. 24	25.5	17.2	2.5	2.4	2.7
1884.					
Jan. 20	22.7	14.9	1.6	2.0	1.4
Feb. 18	22.5	14.7	1.3	2.5	1.5
Mar. 21	26.3	13.6	0.6	2.3	1.3
Apr. 16	27.9	19.1	1.7	3.8	2.3
June 26	25.8	16.3	1.5	1.6	1.1
1885.					
Jan. 7	20.7	13.4	2.6	0.7	1.4
Jan. 26	27.5	18.7	3.1	2.7	2.3
Sept. 22	21.6	16.8	1.3	2.1	2.0
Nov. 9	23.7	15.7	0.5	1.3	2.1
1886.					
Jan. 5	29.8	21.2	0.8	3.9	2.6
Apr. 1	32.2	24.2	5.5	8.5	6.4
May 21	32.5	24.5	4.5	4.8	3.8
1887.					
July 31	34.5	28.5	5.4	5.5	2.5
Aug. 10	33.0	13.8	3.8	2.5	1.4

Date.	Stage.	Rise.	Rainfall three days previous.		
			Augusta.	Atlanta.	Mean of 5.
	Feet.	*Feet.*	*Inches.*	*Inches.*	*Inches.*
1888.					
Jan. 2	25.0	15.2	1.8	1.2	1.4
Feb. 26	29.0	15.0	1.0	1.4	1.4
Mar. 30	32.7	23.0	2.4	3.9	2.1
Sept. 11	38.1	22.1	3.7	0.6	1.6
Nov. 11	24.5	14.9	0.2	1.8	1.4
1889.					
Feb. 19	32.9	22.8	0.5	2.3	1.8
1890.					
Oct. 1	28.5	20.2	1.4	0.5	0.7
Oct. 24	27.7	20.0	2.8	2.3	2.3
1891.					
Jan. 13	21.3	13.7	1.6	1.7	1.4
Feb. 9	27.2	12.6	1.4	1.8	1.5
Mar. 10	35.3	23.5	2.5	3.5	3.1
Mar. 28	29.1	16.9	1.3	1.4	1.4
Apr. 3	23.5	8.0	1.0	1.4	1.4

An inspection of the foregoing table shows that the rises of the Savannah River at Augusta, Ga., follow more closely the depth of rainfall at Augusta than the average rainfall at Augusta, Atlanta, Knoxville, Chattanooga, and Charlotte.

The rise at Augusta, however, coincides better with the average of the rainfall at Augusta and Atlanta than at Augusta alone. Sometimes the rainfall at Charlotte is a better measure of rise than the rainfall at Atlanta.

The rises of the Savannah river at Augusta usually culminate in two days.

As a measure of the rise the mean of the rainfalls at Augusta and Atlanta will be taken for the three days preceding the occurrance of a wave crest at Augusta.

The following are certain stages of river at Augusta, Ga., the subsequent rises in two or three days, and the average rainfall at Augusta and Atlanta in three days, all arranged according to the magnitude of the rainfall:

Three-day rainfall, Augusta and Atlanta.	River stage.	Observed rise to crest.	Computed rise.	Three-day rainfall, Augusta and Atlanta.	River stage.	Observed rise to crest.	Computed rise.
Inches.	*Feet.*	*Feet.*		*Inches.*	*Feet.*	*Feet.*	
0.9	8	16		1.7	8	21	16
1.0	10	15		1.8	9	14	16
1.0	8	20		1.5	13	14	10
				1.6	9	16	13
Mean 1.0	9	17		1.8	8	15	16
				1.9	8	15	18
1.3	5	18		1.6	10	16	12
1.2	8	16		1.6	7	13	15
1.5	12	14	11	1.7	5	17	17
1.5	10	15	12	1.6	8	13	15
1.2	14	15		1.6	14	13	11
1.4	10	23					
1.4	12	17		Mean 1.7	9	15	
1.2	15	8					
				2.4	19	9	21
Mean 1.3	1.1	16		2.1	18	9	16

Three-day rainfall, Augusta and Atlanta.	River stage.	Observed rise to crest.	Computed rise.	Three-day rainfall, Augusta and Atlanta.	River stage.	Observed rise to crest.	Computed rise.
Inches.	*Feet.*	*Feet.*		*Inches.*	*Feet.*	*Feet.*	
2.1	8	21	19	3.3	10	17	21
2.0	6	16	19	3.2	19	14	16
2.4	8	17	19	3.2	10	23	21
2.4	9	21	19	3.0	12	23	19
				3.6	7	23	24
Mean 2.2	8	19		3.7	16	22	18
2.8	10	20	20	Mean 3.3	12	20	
2.8	9	19	20	4.2	7	23	24
2.9	9	19	21	4.6	8	25	24
2.6	8	20	20	5.2	8	24	24
				5.5	6	29	26
Mean 2.8	9	20		7.0	8	24	26

In a rise of 10 feet at a low stage there is a less increase in the passing water than for a rise of the same amount at a high stage.

The increased quantity of passing water will be taken as proportional to the rise multiplied by the mean stage.

The quantity of water passing Augusta will be taken as proportional to the depth of the average rainfall at Augusta and Atlanta for rainfalls from 1.5 to 5 inches.

As may be seen from the foregoing table the product of mean stage by rise does not begin to vary perceptibly with the rainfall until it exceeds 1.5 inches.

There is not sufficient number of cases of great rainfalls to determine the relation between the rise and rainfall when greater than 5 inches.

From the data above and on the assumptions stated, solving graphically the following table is derived giving the rises at Augusta, Ga., dependent on the rainfall and the initial stage of river.

RISE OF THE SAVANNAH RIVER AT AUGUSTA, GA., THREE-DAY RAINFALL, AVERAGE OF AUGUSTA AND ATLANTA.

Rainfall.	Stage (in feet), Augusta.							
	6	8	10	12	14	16	18	20
Inches.								
1.5	15	14	12	11	10	10	9	8
2.0	19	18	16	15	14	13	12	12
2.5	22	20	19	18	17	16	15	14
3.0	23	22	20	19	18	17	16	15
3.5	24	23	22	20	19	18	17	16
4.0	25	23	22	21	19	18	17	16
4.5	25	24	22	21	20	19	18	17
5.0	26	24	23	21	20	19	18	17

It is inexpedient to predict any rise in the Savannah River for a less rainfall than 1.5 inches. Important rises do occasionally occur with much less rain than 1 inch, but in general such is not the case.

The area drained by the Savannah River above Augusta, Ga., is about 7,500 square miles.

WASHINGTON CITY.

The Potomac drains an area of 13,680 square miles above Washington City. The highest water, 12.3 feet, above low water occurred June 2, 1889. This carried the water to the store doors on the north side of Pennsylvania avenue between Ninth and Tenth streets. This stage was preceded at Harpers Ferry June 1 by a stage of 34 feet.

The stage of water at Washington November 26, 1877, was 9.1 feet above low water. This was preceded by a stage of 27.2 feet at Harpers Ferry.

The rise at Washington City is 0.35 of the rise preceding at Harpers Ferry.

The difference between high and low tide at Long Bridge, Washington City, is 2.9 feet. The tide at Chain Bridge is 1.5 feet.

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY.

[From Monthly Weather Review.]

Locality.	Date.	Amount.
		Inches.
Portsmouth, Ohio	July 27, 1837	4.2
Do	June 26, 1840	4.6
Lambertville, N. J	Aug. 22, 1843	7.1
Do	Aug. 23, 1845	4.4
St. Louis, Mo	Oct. 21, 1847	4.6
St. Louis, Mo	May 17, 1848	5.2
Do	June 2, 1848	6.2
Do	June 22, 1848	4.4
Do	Aug. 15, 1848	5.0
Lambertville, N. J	Sept. 2, 1850	8.0
Lambertville, N. J	July 19, 1850	4.7
St. Louis, Mo	June 23, 1852	4.4
Do	Aug. 15, 1855	4.2
Hanover, N. H	Aug. 6, 1856	5.6
Lambertville, N. J	Aug. 10, 1857	4.2
St. Louis, Mo	July 10, 1858	4.2
Do	Dec. 4, 1858	5.0
Do	June 22, 1859	4.2
Fort Arbuckle, Ind. T	Apr. 20, 1860	6.0
Peoria, Ill	July 1, 1860	4.1
Colorado Camp, Tex	Aug. 28, 1860	7.6
Lambertville, N. J	Sept. 20, 1860	4.5
Fort Columbus, N. Y	June 5, 1862	5.4
Fort Adams, R. I	Apr. 17, 1863	4.0
Fort Leavenworth, Kans	Aug. 6, 1863	5.1
Fort Independence, Mass	May 3, 1864	4.4
Camp Dennison, Ohio	Sept. 4, 1864	4.8
Hilton Head, S. C	Sept. 21, 1864	4.2
Spartanburg, S. C	...do	9.4
St. Louis, Mo	Mar. 30, 1865	4.9
Lambertville, N. J	July 16, 1865	12.0
Ardenia, N. Y	Oct. 30, 1866	5.0
St. Louis, Mo	May 27, 1867	4.4
Fort Ripley, Minn	July 18, 1867	7.5
Carlisle, Pa	May 13, 1868	4.6
Fort Philip Kearny, Wyo	June 5, 1868	4.1
Do	June 24, 1868	4.0
Fort Delaware, Del	Sept. 4, 1868	10.7
Do	Dec. 5, 1868	4.0
Fort Sully, S. Dak	Aug. 30, 1869	4.3

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Hanover, N. H	Sept. 10, 1869	4.7
Fort Brown, Tex	Sept. 22, 1869	4.7
Fort Washington, Md	Oct. 4, 1869	5.7
Hanover, N. H	do	5.9
Natchez, Miss	Oct. 23, 1869	6.0
Rock Island Arsenal, Ill	Nov. 19, 1869	4.6
Fort Leavenworth, Kans	May 30, 1870	4.4
Austin, Tex	do	7.6
Fort Independence, Mass	June 21, 1870	4.3
Fort Delaware, Del	Aug. 11, 1870	5.2
McPherson Barracks, Ga	Sept. 29, 1870	6.3
Carlisle, Pa	Sept. 30, 1870	4.5
Austin, Tex	Oct. 18, 1870	12.3
Fort Totten, N. Dak	June 4, 1871	4.0
Galveston, Tex	do	4.6
Omaha, Nebr	July 28, 1871	4.4
Carlisle, Pa	Aug. 8, 1871	4.9
Savannah, Ga	Aug. 10, 1871	8.1
Charleston, S. C	do	4.0
Fort Hays, Kans	Sept. 12, 1871	7.0
Galveston, Tex	Oct. 2, 1871	7.8
Boston, Mass	Oct. 12, 1871	4.2
Fort Independence, Mass	do	4.7
New London, Conn	do	4.3
Galveston, Tex	Oct. 30, 1871	7.9
Fort Leavenworth, Kans	Dec. 23, 1871	4.6
Savannah, Ga	Mar. 2, 1872	4.1
Mobile, Ala	Mar. 24, 1872	6.5
Augusta, Ga	Mar. 25, 1872	4.4
New Orleans, La	do	4.5
Fort Randall, S. Dak	May 15, 1872	6.1
Vicksburg, Miss	May 24, 1872	5.4
Peoria, Ill	June 6, 1872	4.9
Fort McIntosh, Tex	June 8, 1872	4.2
Austin, Tex	June 9, 1872	4.9
Key West, Fla	June 9, 1872	4.0
Keokuk, Iowa	July 22, 1872	4.3
Fort Johnson, N. C	July 29, 1872	4.0
Savannah, Ga	Aug. 6, 1872	9.6
Wilmington, N. C	do	5.4
Wilmington, N. C	Sept. 13, 1872	4.1
Jacksonville, Fla	Oct. 23, 1872	5.9
Galveston, Tex	Nov. 6, 1872	5.6
New Orleans, La	Nov. 8, 1872	4.5
Vicksburg, Miss	Dec. 19, 1872	5.0
New Orleans, La	May 6, 1873	4.0
Do	May 28, 1873	4.5
St. Louis, Mo	June 10, 1873	4.1
St. Paul, Minn	June 23, 1873	4.6
Marquette, Mich	July 16, 1873	4.1

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Mobile, Ala	July 21, 1873	5.7
Baltimore, Md	Aug. 18, 1873	4.4
Philadelphia, Pa	do	5.2
Jacksonville, Fla	Aug. 20, 1873	4.4
New Orleans, La	Aug. 21, 1873	4.1
Galveston, Tex	Aug. 21, 1873	4.1
Fort Brown, Tex	Sept. 10, 1873	8.8
Austin, Tex	Sept. 13, 1873	6.4
Fort Brown, Tex	Sept. 14, 1873	5.9
Mobile, Ala	Sept. 17, 1873	5.3
Fort Barrancas, Fla	Sept. 18, 1873	5.8
Columbia, S. C	Sept. 19, 1873	4.8
Jacksonville, Fla	Oct. 3, 1873	4.1
Galveston, Tex	Nov. 3, 1873	4.1
Shreveport, La	Nov. 22, 1873	4.0
Louisville, Ill	Dec. 3, 1873	5.7
Mount Carmel, Utah	Jan. 3, 1874	4.0
Wilmington, N. C	Jan. 5, 1874	4.6
Mount Carmel, Utah	Jan. 15, 1874	4.0
Clarksville, Tex	Jan. 31, 1874	4.0
Oneida, N. Y	Feb. 13, 1874	10.1
Nashville, Tenn	Feb. 22, 1874	6.0
Clarksville, Tex	Feb. 28, 1874	7.0
Mount Carmel, Utah	Mar. 4, 1874	5.0
Mobile, Ala	Mar. 15, 1874	4.5
Montgomery, Ala	Mar. 16, 1874	4.7
Carlowville, Ala	Mar. 18, 1874	10.5
Vicksburg, Miss	Apr. 8, 1874	4.5
Do	Apr. 15, 1874	4.2
Brookhaven, Miss	Apr. 16, 1874	4.4
Knoxville, Tenn	Apr. 16, 1874	4.2
Brookhaven, Miss	Apr. 19, 1874	7.4
Vicksburg, Miss	do	4.9
Fort Sully, S. Dak	May 2, 1874	4.6
Clarksville, Tex	May 11, 1874	8.2
Fort Wallace, Kans	May 23, 1874	9.3
Galveston, Tex	May 28, 1874	5.2
Augusta, Ga	June 5, 1874	4.5
Emerson, Nebr	do	4.0
Colebrook, Conn	June 8, 1874	7.4
Sandwich, Ill	do	5.0
Plattsmouth, Nebr	June 9, 1874	5.5
Independence, Kans	June 14, 1874	4.0
Plattsmouth, Nebr	do	5.6
New Orleans, La	July 4, 1874	7.5
Oneida, N. Y	July 4, 1874	5.2
Woodlawn, Md	July 11, 1874	4.4
Fort Larned, Kans	July 15, 1874	5.6
Tarentum, Pa	July 26, 1874	4.5
Rising Sun, Ind	July 27, 1874	4.4

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Trumbull, Conn	Aug. 8, 1874	7.3
New Haven, Conn	Aug. 9, 1874	8.7
Somerset, Mass	do	5.1
Philadelphia, Pa	do	4.1
Carroll, Mont	Aug. 11, 1874	4.0
Charleston, S. C	Aug. 30, 1874	4.7
Fort Brown, Tex	Sept. 5, 1874	10.1
Bluff Settlement, Tex	Sept. 6, 1874	6.5
Austin, Tex	Sept. 7, 1874	8.4
Fort McKavett, Tex	do	5.4
Council Grove, Kans	Sept. 14, 1874	4.8
Washington City	Sept. 16, 1874	5.7
Fort Foote, Md	do	4.1
St. Inigoes, Md	do	6.0
Hatteras, N. C	do	5.4
Cooper Union, N. Y	Sept. 17, 1874	5.1
Rock Island, Ill	Sept. 18, 1874	4.0
Mount Vernon, Iowa	do	4.0
Davenport, Iowa	Sept. 19, 1874	4.5
Clarksville, Tex	Sept. 24, 1874	4.0
Bluff Settlement, Tex	Sept. 25, 1874	4.8
Oxford, N. C	Sept. 28, 1874	4.5
Attaway Hill, N. C	Sept. 29, 1874	6.0
Fort Brown, Tex	Nov. 13, 1874	4.3
Bluff Settlement, Tex	Nov. 16, 1874	8.0
Fort Independence, Mass	Nov. 22, 1874	5.2
San Francisco, Cal	Nov. 23, 1874	4.0
Rapid City, S. Dak	Dec. 2, 1874	4.6
Cooper Union, New York City	Dec. 20, 1874	5.0
Clarksville, Tex	Dec. 30, 1874	8.5
Clarksville, Tex	Dec. 31, 1874	6.0
Memphis, Tenn	Jan. 28, 1875	4.0
Clarksville, Tex	do	6.5
New Orleans, La	Feb. 19, 1875	5.7
Jacksonville, Fla	Feb. 20, 1875	4.0
Capeville, Va	Feb. 20, 1875	6.1
Knoxville, Tenn	Feb. 24, 1875	4.3
Murphy, N. C	Mar. 1, 1875	4.2
Spartanburg, S. C	Mar. 3, 1875	4.9
Clarksville, Tex	Mar. 28, 1875	6.0
Hatteras, N. C	Apr. 3, 1875	4.6
Yankton, S. Dak	Apr. 7, 1875	4.6
Fort Gibson, Ind. T	Apr. 30, 1875	4.7
Fort Sill, Ind. T	May 23, 1875	4.5
Council Bluffs, Iowa	May 31, 1875	5.0
Omaha, Nebr	May 31, 1875	4.5
Clear Creek, Nebr	June 1, 1875	8.8
Boston, Mass	June 10, 1875	5.4
Fort Independence, Mass	do	5.0
Somerset, Mass	do	5.7

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Wyanett, Ill	June 14, 1875	4.0
Omaha, Nebr	June 17, 1875	5.0
Fort Randall, S. Dak	June 18, 1875	4.8
Wilmington, N. C	June 20, 1875	4.0
Cresco, Iowa	June 23, 1875	4.0
Rockford, Iowa	June 23, 1875	5.5
Emerson, Nebr	June 27, 1875	4.2
Fort Randall, S. Dak	June 30, 1875	5.1
Yankton, S. Dak	do	5.2
Sidney Barracks, Nebr	July 19, 1875	4.0
Santee, Nebr	July 30, 1875	4.1
Keokuk, Iowa	July 31, 1875	4.3
Johnsontown, Va	Aug. 8, 1875	4.9
Stapleton, N. Y	Aug. 12, 1875	4.0
Norfolk, Nebr	Aug. 27, 1875	6.7
Plattsmouth, Nebr	Aug. 27, 1875	6.7
Hampton, Va	Aug. 29, 1875	5.7
Denison, Iowa	Sept. 2, 1875	4.9
Abingdon, Ill	Sept. 9, 1875	4.0
Augusta, Ill	do	4.8
Dubuque, Iowa	Sept. 9, 1875	5.0
Beloit, Wis	do	6.1
Bloomfield, Wis	do	4.8
Arkansas City, Kans	Sept. 12, 1875	4.0
Galveston, Tex	Sept. 16, 1875	6.6
Shreveport, La	Sept. 17, 1875	7.0
Galveston, Tex	do	4.0
Vicksburg, Miss	Sept. 18, 1875	5.0
New Orleans, La	Sept. 25, 1875	5.3
Galveston, Tex	do	6.6
Litchfield, Mich	Oct. 6, 1875	4.5
Hatteras, N. C	Oct. 14, 1875	5.3
Columbia, Conn	Oct. 31, 1875	4.1
Austin, Tex	Nov. 28, 1875	4.2
New Ulm, Tex	Dec. 3, 1875	5.6
Shreveport, La	Dec. 21, 1875	4.7
Galveston, Tex	Dec. 22, 1875	4.6
Brookhaven, Miss	Dec. 24, 1875	4.0
Franklin, N. C	Dec. 29, 1875	4.7
Hacienda Saluda, S. C	do	5.0
Cairo, Ill	Jan. 18, 1876	5.2
Terrell, Tex	Mar. 5, 1876	6.0
Fort Hays, Kans	Mar. 19, 1876	4.7
Shreveport, La	do	4.5
Terrell, Tex	do	4.0
New Orleans, La	Mar. 20, 1876	4.0
Terrell, Tex	Mar. 24, 1876	4.0
New Haven, Conn	Mar. 26, 1876	4.8
Terrell, Tex	Mar. 31, 1876	5.0
Montgomery, Ala	Apr. 2, 1876	6.0

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Jacksonville, Fla	Apr. 3, 1876	4.7
New Haven, Conn	Apr. 4, 1876	5.9
New London, Conn	...do	4.7
New Orleans, La	Apr. 7, 1876	5.5
Murphy, N. C	Apr. 14, 1876	4.3
Shreveport, La	May 6, 1876	7.4
New Orleans, La	May 8, 1876	4.1
Louisville, Ill	May 20, 1876	4.0
Denver, Colo	May 22, 1876	6.7
Belleville, Kans	June 10, 1876	4.0
Charleston, S. C	June 12, 1876	6.2
Burlington, Kans	June 13, 1876	5.0
Lawrence, Kans	...do	4.7
Charleston, S. C	...do	4.7
Savannah, Ga	June 15, 1876	5.1
Purdy, Tenn	June 15, 1876	7.2
Greensboro, N. C	June 17, 1876	5.6
Atchison, Kans	June 28, 1876	4.5
Baxter Springs, Kans	June 29, 1876	4.5
Carbondale, Ill	June 30, 1876	4.3
Wilmington, N. C	June 30, 1876	7.0
Keokuk, Iowa	July 4, 1876	5.1
Dubuque, Iowa	July 5, 1876	4.6
Beloit, Wis	...do	4.5
Charleston, S. C	July 16, 1876	4.9
Belleville, Kans	July 23, 1876	4.0
Washington City	July 30, 1876	4.1
Middletown, Conn	July 31, 1876	5.8
New Haven, Conn	...do	7.0
Worcester, Mass	...do	4.6
Mobile, Ala	Aug. 4, 1876	4.0
Boonsboro, Va	Aug. 13, 1876	5.2
Guttenburg, Iowa	Aug. 30, 1876	4.2
Abingdon, Ill	Sept. 5, 1876	4.3
Keokuk, Iowa	Sept. 7, 1876	4.9
Augusta, Ill	Sept. 8, 1876	5.3
Wilmington, N. C	Sept. 16, 1876	4.0
Fort Johnson, N. C	Sept. 17, 1876	4.0
Capeville, Va	...do	6.0
Erie, Pa	Sept. 18, 1876	4.4
Pittsburg, Pa	Sept. 18, 1876	4.1
Tarentum, Pa	...do	6.0
Wellsboro, Pa	Sept. 24, 1876	4.8
Newport, Fla	Oct. 7, 1876	4.4
Do	Oct. 8, 1876	8.2
Quitman, Ga	Oct. 11, 1876	14.2
Charleston, S. C	Oct. 20, 1876	6.2
Daytona, Fla	...do	8.2
Hatteras, N. C	Oct. 21, 1876	5.4
Louisville, Ky	Oct. 29, 1876	4.1

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Dover, Del	Nov. 20, 1876	7.6
Boston, Mass	Nov. 21, 1876	5.4
Clarksville, Tex	Dec. 29, 1876	8.5
Melissa, Tex	Feb. 13, 1877	7.3
Hatteras, N. C	Mar. 22, 1877	5.1
Montgomery, Ala	Apr. 8, 1877	4.6
Norfolk, Va	Apr. 10, 1877	4.6
Melissa, Tex	Apr. 17, 1877	5.0
Sedgwick, Kans	May 12, 1877	4.5
Ellinwood, Kans	May 18, 1877	5.0
Fort Snelling, Minn	May 31, 1877	5.1
Bellefontaine, Ohio	June 6, 1877	5.1
New London, Conn	June 7, 1877	4.2
Memphis, Tenn	June 8, 1877	9.0
Do	June 9, 1877	10.0
Savannah, Ga	June 12, 1877	4.8
Charleston, S. C	June 12, 1877	4.0
St. Marys, Ga	June 13, 1877	6.2
Mobile, Ala	June 14, 1877	4.8
Carthagena, Ohio	June 20, 1877	5.2
Urbana, Ohio	June 21, 1877	4.9
Fort Snelling, Minn	June 29, 1877	4.2
Augusta, Ill	July 16, 1877	4.2
St. Marys, Ga	July 22, 1877	4.3
Greenville, N. C	Aug. 3, 1877	5.7
Mystic, Conn	Aug. 25, 1877	4.0
Amana, Iowa	Aug. 28, 1877	4.0
Byron Township, Iowa	Aug. 28, 1877	4.4
Monticello, Iowa	do	4.0
Embarrass, Wis	do	4.0
Boonesboro, Iowa	Aug. 29, 1877	9.4
Wilmington, N. C	Sept. 1, 1877	5.0
Shreveport, La	Sept. 3, 1877	6.9
Galveston, Tex	Sept. 6, 1877	4.8
Cape May, N. J	Sept. 8, 1877	4.7
Mount Ida, Ark	Sept. 9, 1877	4.0
St. Joseph, Mo	do	4.8
Baton Rouge, La	Sept. 10, 1877	4.8
Galveston, Tex	Sept. 17, 1877	6.1
Mobile, Ala	Sept. 18, 1877	7.0
New Orleans, La	Sept. 18, 1877	7.2
Baton Rouge, La	Sept. 19, 1877	12.4
Brookhaven, Miss	Sept. 19, 1877	7.2
Fayette, Miss	do	6.2
Carlowville, Ala	Sept. 20, 1877	10.4
Green Springs, Ala	Sept. 20, 1877	8.2
Wilmington, N. C	Sept. 27, 1877	5.6
Hatteras, N. C	Sept. 28, 1877	5.9
Cape Lookout, N. C	Sept. 29, 1877	9.0
Greenville, N. C	do	8.3

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Kitty Hawk, N. C	Sept. 29, 1877	7.2
Mayport, Fla	Oct. 3, 1877	6.3
St. Marks, Fla	Oct. 3, 1877	7.3
Quitman, Ga	....do	8.9
Lynchburg, Va	....do	5.4
Washington City	Oct. 4, 1877	4.0
Emmitsburg, Md	....do	4.1
Fallston, Md	Oct. 4, 1877	5.1
New Market, Md	....do	5.1
Woodstock College, Md	....do	5.2
Flushing, N. Y	Oct. 4, 1877	4.8
New York City, N. Y	....do	4.0
Pelham Manor, N. Y	Oct. 4, 1877	5.0
West Chester, Pa	....do	5.0
Accotink, Va	....do	4.0
Fort Myer, Va	Oct. 4, 1877	4.3
Woodlawn, Va	....do	4.0
Boston, Mass	Oct. 5, 1877	4.0
Fort Hamilton, N. Y	....do	4.9
New York City	Oct. 7, 1877	4.3
White Plains, N. Y	Oct. 9, 1877	9.7
Alpena, Mich	Oct. 11, 1877	5.2
Fort Sill, Ind. T	Oct. 14, 1877	4.2
Denison, Tex	....do	4.0
Indianola, Tex	Oct. 16, 1877	4.1
Baton Rouge, La	Oct. 18, 1877	6.7
Galveston, Tex	Oct. 24, 1877	5.5
Galveston, Tex	Oct. 25, 1877	4.0
Point Pleasant, La	Nov. 1, 1877	4.0
Belmont Farm, Tex	....do	7.0
Point Pleasant, La	Nov. 8, 1877	6.8
Charleston, S. C	....do	4.2
Mount Washington, N. H	Nov. 9, 1877	4.7
Belmont Farm, Tex	Nov. 17, 1877	4.0
Fort Barrancas, Fla	Nov. 20, 1877	4.3
Point Pleasant, La	Nov. 20, 1877	7.1
Lynchburg, Va	Nov. 22, 1877	4.2
Statesville, N. C	Nov. 23, 1877	4.5
Sandy Springs, Md	Nov. 24, 1877	5.0
Boonsboro, Va	....do	4.5
Mount Solon, Va	Nov. 24, 1877	4.6
Barnegat City, N. J	Nov. 25, 1877	5.3
Cornish, Me	Nov. 27, 1877	4.1
Fort Barrancas, Fla	Dec. 4, 1877	5.4
Quitman, Ga	Dec. 5, 1877	4.7
Hatteras, N. C	Dec. 19, 1877	4.2
Kitty Hawk, N. C	Dec. 26, 1877	4.4
Melissa, Tex	Dec. 28, 1877	5.0
New Haven, Conn	Feb. 22, 1878	4.1
Shreveport, La	Mar. 8, 1878	4.5

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Vicksburg, Miss	Mar. 9, 1878	4.5
St. Marks, Fla	Mar. 28, 1878	5.0
Tybee Island, Ga	Apr. 9, 1878	4.4
Charleston, S. C	do	5.3
Breckenridge, Minn	Apr. 11, 1878	5.1
Memphis, Tenn	Apr. 23, 1878	4.0
Clarksville, Tex	May 21, 1878	5.5
Tabor, Iowa	May 29, 1879	4.2
Barnegat, N. J	May 31, 1878	5.4
Boonesboro, Iowa	June 2, 1878	4.0
Terrell, Tex	June 12, 1878	4.5
Danville, Ky	June 17, 1878	5.0
Fort Larned, Kans	June 19, 1878	6.0
Marquette, Mich	June 21, 1878	5.2
Montgomery, Ala	June 23, 1878	4.0
Melissa, Tex	June 28, 1878	5.1
De Soto, Nebr	June 29, 1878	4.6
Howard, Nebr	June 29, 1878	4.6
Logan, Iowa	June 30, 1878	6.0
Louisville, Ill	July 1, 1878	5.0
Logan, Iowa	July 10, 1878	8.0
Plattsmouth, Nebr	do	4.8
Tucson, Ariz	July 11, 1878	5.1
Guttenburg, Iowa	do	5.4
Beloit, Wis	do	4.6
Bloomfield, Wis	July 11, 1878	7.0
Quitman, Ga	July 12, 1878	4.0
Riley, Ill	July 12, 1878	4.3
New Corydon, Ind	do	5.0
Charleston, S. C	July 14, 1878	5.1
New Bedford, Mass	July 18, 1878	4.4
Morriston, S. Dak	July 23, 1878	8.0
Manhattan, Kans	July 24, 1878	6.1
Chicago, Ill	July 26, 1878	4.1
Denison, Tex	July 27, 1878	6.6
Rio Grande City, Tex	July 27, 1878	4.2
St. Meinrad's Abbey, Ind	July 29, 1878	5.3
Decatur, Tex	July 29, 1878	6.1
Fort Griffin, Tex	do	6.7
Wytheville, Va	do	4.4
Washington City	July 30, 1878	5.8
Fort Myer, Va	do	4.7
Colebrook, Conn	Aug. 4, 1878	6.7
Mendon, Mass	do	5.9
Lowell, Mass	Aug. 9, 1878	4.0
Weir Lake, Mass	Aug. 9, 1878	6.5
Weldon, N. C	Aug. 13, 1878	4.8
Aiken, S. C	Aug. 14, 1878	5.1
Charleston, S. C	do	5.4
Woods Holl, Mass	Aug. 18, 1878	5.1

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Brookville, Iowa	Aug. 20, 1878	4.6
Elmira, Ill	...do	4.0
Mount Pleasant, Iowa	Aug. 20, 1878	4.6
Fort Barrancas, Fla	Aug. 29, 1878	9.8
Egypt, Pa	Sept. 4, 1878	4.2
New Haven, Conn	Sept. 5, 1878	6.7
Merritt's Island, Fla	Sept. 8, 1878	5.2
Do	Sept. 9, 1878	9.1
Do	Sept. 10, 1878	7.0
St. Francis (Barracks), Fla	...do	5.6
Jacksonville, Fla	Sept. 11, 1878	4.3
Wilmington, N. C	...do	4.0
Augusta, Ga	Sept. 12, 1878	4.4
Fayetteville, N. C	...do	4.0
Lenoir, N. C	...do	7.1
Charleston, S. C	Sept. 12, 1878	4.3
Wytheville, Va	...do	7.0
Cleveland, Ohio	Sept. 13, 1878	4.4
Hudson, Ohio	...do	5.8
Marietta, Ohio	...do	4.6
New Castle, Pa	Sept. 13, 1878	5.0
Thomasville, Ga	Oct. 10, 1878	5.0
Fort Barrancas, Fla	...do	5.4
Hatteras, N. C	Oct. 11, 1878	4.0
Key West, Fla	Oct. 21, 1878	4.0
Emory Grove, Md	Oct. 22, 1878	4.0
Cape Lookout, N. C	...do	4.1
Southport, N. C	...do	4.4
Sandy Springs, Md	...do	3.6
Carlisle, Pa	Oct. 23, 1878	4.0
Gardiner, Me	Oct. 24, 1878	4.9
West Waterville, Me	...do	6.3
Thatcher's Island, Mass	Nov. 19, 1878	5.8
Auburn, N. H	Nov. 22, 1878	4.0
Fort Barrancas, Fla	Nov. 26, 1878	10.4
Highlands, N. C	Nov. 26, 1878	4.0
Emory Grove, Md	Nov. 27, 1878	4.0
Fayetteville, N. C	...do	4.2
Point Pleasant, La	Dec. 9, 1878	7.0
Ardenia, N. Y	Dec. 10, 1878	4.5
Fayetteville, N. C	Dec. 10, 1878	6.0
Hatteras, N. C	...do	4.2
Boyd's Corners N. Y	Dec. 11, 1878	5.0
Morse, Kans	Dec. 13, 1878	4.5
Galveston, Tex	Dec. 20, 1878	4.7
Point Pleasant, La	Dec. 21, 1878	4.8
Cape Lookout, N. C	...do	4.8
Fayetteville, N. C	...do	6.0
Santa Barbara, Cal	Dec. 31, 1878	4.0
Mobile, Ala	Mar. 21, 1879	4.2

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Fort Stevens, Oregon	Mar. 25, 1879	8.0
Hatteras, N. C	Mar. 30, 1879	6.7
St. Marks, Fla	Apr. 15, 1879	5.2
Shreveport, La	do	4.6
Savannah, Ga	Apr. 17, 1879	6.1
Charleston, S. C	Apr. 17, 1879	5.1
Fort Sill, Ind. T	Apr. 22, 1879	6.5
Corsicana, Tex	do	6.3
Austin, Tex	Apr. 23, 1879	4.4
Clarksville, Tex	Apr. 23, 1879	5.5
Melissa, Tex	Apr. 23, 1879	8.0
Hat Creek, Wyo	do	6.7
New Ulm, Tex	Apr. 24, 1879	5.1
Fayetteville, N. C	Apr. 28, 1879	6.2
Gatesville, Tex	May 5, 1879	4.1
Emory Grove, Md	May 15, 1879	5.0
Sandy Springs, Md	May 16, 1879	4.3
Piegan, Mont	May 24, 1879	4.1
Arlington, Ind	May 26, 1879	4.8
Wakeville, Kans	May 30, 1879	4.0
St. Marks, Fla	June 9, 1879	5.2
St. Joseph, Mo	June 10, 1879	4.3
Fort Griffin, Tex	June 21, 1879	10.2
Des Moines, Iowa	June 24, 1879	4.8
Little Rock, Ark	June 28, 1879	7.4
Cairo, Ill	June 28, 1879	5.0
Fort Barrancas, Fla	June 29, 1879	4.8
Fort Snelling, Minn	July 3, 1879	6.6
St. Paul, Minn	do	5.0
Mount Sterling, Ill	July 7, 1879	4.0
La Crosse, Wis	July 7, 1879	4.7
Mount Sterling, Ill	July 9, 1879	4.3
Monticello, Iowa	do	5.6
Southport, N. C	July 14, 1879	5.0
Nashville, Tenn	July 25, 1879	5.1
Hulmeville, Pa	July 26, 1879	4.0
Irwin, Pa	do	7.0
Fayetteville, N. C	July 28, 1879	6.5
Wooster, Ohio	July 29, 1879	6.6
Charlotte, N. C	July 30, 1879	4.2
Cape Henry, Va	July 31, 1879	4.2
St. Marks, Fla	Aug. 1, 1879	6.4
Franklin, N. C	Aug. 2, 1879	5.9
Rio Grande City, Tex	Aug. 11, 1879	6.0
Ringgold, Barracks, Tex	Aug. 12, 1879	5.0
Brookhaven, Miss	Aug. 13, 1879	4.5
Fort Barrancas Fla	Aug. 14, 1879	6.1
Anna, Ill	Aug. 15, 1879	4.3
St. Meinrad's Abbey, Ind	do	4.6
Lenoir, N. C	Aug. 16, 1879	5.5

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Wilmington, N. C	Aug. 17, 1879	4.7
New Haven, Conn	Aug. 18, 1879	5.1
New London, Conn	do	4.6
Springfield, Mass	do	4.3
Cape May, N. J	do	8.5
Freehold, N. J	Aug. 18, 1879	7.6
Sandy Hook, N. J	do	6.4
Trenton, N. J	do	4.6
Fort Hamilton, N. Y	do	5.0
Wilmington, N. C	do	4.2
Fort Monroe, Va	Aug. 18, 1879	5.0
Johnsontown, Va	do	7.7
Norfolk, Va	do	6.0
Boston, Mass	Aug. 19, 1879	5.0
Little Rock, Ark	Aug. 23, 1879	4.0
Anna, Ill	Aug. 23, 1879	5.1
Point Pleasant, La	do	6.7
Louisville, Ill	Aug. 24, 1879	5.5
St. Marks, Fla	Aug. 26, 1879	4.5
Merritts Island, Fla	Aug. 30, 1879	4.8
St. Marks, Fla	Sept. 1, 1879	4.1
Brookhaven, Miss	do	6.0
Fayette, Miss	Sept. 1, 1879	5.0
Vicksburg, Miss	Sept. 2, 1879	4.0
Ashwood, Tenn	do	4.0
Fort Wayne, Ind	Sept. 3, 1879	4.1
St. Meinrad's Abbey, Ind	do	4.2
Cape Lookout, N. C	Sept. 21, 1879	5.1
Hatteras, N. C	do	5.2
Belmont Farm, Tex	Oct. 3, 1879	4.5
Indianola, Tex	Oct. 3, 1879	4.7
Key West, Fla	Oct. 13, 1879	4.2
Asheville, N. C	Oct. 18, 1879	6.4
Franklin, N. C	do	7.0
Murphy, N. C	do	4.3
Webster, N. C	Oct. 18, 1879	6.7
Fort Barrancas, Fla	do	4.5
Highlands, N. C	Oct. 20, 1879	11.6
Okaloosa, La	Nov. 9, 1879	5.2
Fort Barrancas, Fla	Dec. 5, 1879	5.4
Atlanta, Ga	Dec. 14, 1879	4.1
Red Bluff, Cal	Dec. 19, 1879	5.0
Los Angeles, Cal	Dec. 20, 1879	4.3
Nashville, Tenn	Feb. 13, 1880	5.2
Point Pleasant, La	Mar. 15, 1880	5.0
Vicksburg, Miss	Mar. 15, 1880	4.6
Point Pleasant, La	Apr. 15, 1880	4.0
Fayette, Miss	Apr. 16, 1880	9.0
Sacramento, Cal	Apr. 20, 1880	5.3
Forest City, Cal	Apr. 21, 1880	6.5

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Georgetown, Cal	Apr. 21, 1880	4.0
Grass Valley, Cal	do	4.5
Healdsburg, Cal	do	9.7
Modesto, Cal	do	7.0
Mount St. Helena, Cal	do	14.7
Nevada City, Cal	Apr. 21, 1880	5.2
Santa Rosa, Cal	do	6.7
Tomales, Cal	do	5.0
Mayport, Fla	May 4, 1880	5.5
Nashua, Iowa	May 13, 1880	4.0
Wallace, Fort, Kans	May 14, 1880	4.0
St. Meinrad's Abbey, Ind	May 21, 1880	4.0
Columbus, Ga	May 22, 1880	9.9
Ellsworth, N. C	do	5.5
Osage, Iowa	May 24, 1880	5.4
Fort Barrancas, Fla	May 26, 1880	4.2
Boerne, Tex	May 28, 1880	6.5
St. Meinrad's Abbey, Ind	May 29, 1880	4.5
Vicksburg, Miss	May 30, 1880	4.3
Nashua, Iowa	June 14, 1880	7.5
Galveston, Tex	June 24, 1880	5.3
Hulmeville, Pa	July 6, 1880	4.7
Clear Creek, Nebr	July 7, 1880	4.5
Ruggles, Ohio	July 11, 1880	4.0
Flushing, N. Y	July 12, 1880	4.2
Shreveport, La	July 27, 1880	5.0
Fort Barrancas, Fla	Aug. 3, 1880	4.1
Ellsworth, N. C	do	6.0
Do	Aug. 4, 1880	9.0
Cedar Keys, Fla	Aug. 6, 1880	4.6
Brownsville, Tex	Aug. 12, 1880	7.8
Camp Verde, Tex	Aug. 13, 1880	4.9
Bellefontaine, Ohio	Aug. 20, 1880	5.3
Hatteras, N. C	Aug. 23, 1880	9.1
Fort Totten, N. Dak	Aug. 26, 1880	5.1
Merritts Island, Fla	Aug. 30, 1880	4.7
Cedar Keys, Fla	Aug. 31, 1880	5.3
Quitman, Ga	do	5.0
Vicksburg, Miss	Sept. 1, 1880	5.2
Ellsworth, N. C	do	5.0
Highlands, N. C	Sept. 3, 1880	5.6
Mount Washington, N. H	Sept. 15, 1880	7.4
Pilot Point, Tex	Sept. 20, 1880	5.3
Monticello, Iowa	Sept. 25, 1880	5.0
Nashua, Iowa	do	8.2
Amana, Iowa	Sept. 26, 1880	4.5
Jacksboro, Tex	Oct. 2, 1880	4.1
Jacksonville, Fla	Oct. 8, 1880	4.4
Hatteras, N. C	Oct. 9, 1880	4.4
Jacksonville, Fla	Oct. 10, 1880	4.0

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
St. Augustine, Fla	Oct. 10, 1880	10.3
Lexington, Mo	Oct. 13, 1880	4.3
Ellsworth, N. C	Oct. 29, 1880	6.3
Point Pleasant, La	Oct. 30, 1880	8.6
Quitman, Ga	Nov. 6, 1880	6.7
Fayette, Miss	Nov. 28, 1880	5.6
Ellsworth, N. C	do	5.0
Do	Dec. 2, 1880	5.0
Mount St. Helena, Cal	Dec. 3, 1880	6.6
Do	Dec. 20, 1880	5.7
Mount St. Helena, Cal	Dec. 24, 1880	9.0
San Francisco, Cal	Jan. 29, 1881	4.7
Mobile, Ala	Feb. 6, 1881	4.0
Do	Mar. 11, 1881	4.1
Atlanta, Ga	Mar. 17, 1881	4.6
Hatteras, N. C	Apr. 14, 1881	4.5
Mobile, Ala	Apr. 24, 1881	5.3
Wellsboro, Pa	June 7, 1881	4.0
Boston, Mass	June 10, 1881	4.4
Block Island, R. I	do	6.0
Des Moines, Iowa	June 20, 1881	5.1
Wilmington, N. C	July 1, 1881	4.5
Nashua, Iowa	July 9, 1881	7.8
El Paso, Tex	do	6.5
Nashua, Iowa	July 10, 1881	5.2
Ames, Iowa	July 11, 1881	5.4
La Crosse, Wis	July 20, 1881	4.6
Mobile, Ala	Aug. 2, 1881	6.7
Pensacola, Fla	do	4.3
Pensacola, Fla	Aug. 3, 1881	6.1
Charleston, S. C	Aug. 27, 1881	4.7
Savannah, Ga	Aug. 28, 1881	4.8
Smithville, S. Dak	Sept. 6, 1881	4.1
Shreveport, La	Sept. 14, 1881	4.1
Ellsworth, N. C	Sept. 14, 1881	6.0
Pensacola, Fla	Sept. 15, 1881	5.6
Nashville, Tenn	do	4.2
Cedar Keys, Fla	Sept. 16, 1881	4.8
Ellsworth, N. C	do	13.0
Port Eads, La	Sept. 26, 1881	4.2
Dubuque, Iowa	Sept. 27, 1881	4.4
Nora Springs, Iowa	Sept. 29, 1881	4.0
Howard, Nebr	do	5.8
Omaha, Nebr	do	5.3
Fort Scott, Kans	Sept. 30, 1881	5.2
Independence, Kans	Sept. 30, 1881	4.0
Marquette, Mich	do	4.4
Decatur, Tex	do	4.4
Nelson, Tex	do	4.0
Brackettville, Tex	Oct. 2, 1881	13.1

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Fayette, Miss	Oct. 28, 1881	6.2
Vicksburg, Miss	do	6.6
Highlands, N. C	Oct. 30, 1881	8.3
Mobile, Ala	Nov. 6, 1881	4.5
Point Pleasant, La	Nov. 12, 1881	6.0
Fort Barrancas, Fla	Nov. 16, 1881	6.1
Indianapolis, Ind	Nov. 18, 1881	4.3
Fort Barancas, Fla	Dec. 20, 1881	5.3
Pensacola, Fla	Dec. 21, 1881	4.2
Highlands, N. C	Dec. 26, 1881	5.3
St. Louis, Mo	Feb. 20, 1882	4.4
Wilmington, N. C	Mar. 27, 1882	5.3
Mobile, Ala	Apr. 19, 1882	7.3
Little Rock, Ark	May 7, 1882	4.2
Pike's Peak, Colo	May 8, 1882	4.3
Little Rock, Ark	May 10, 1882	6.3
Charleston, S. C	June 18, 1882	4.1
Atlantic City, N. J	Aug. 16, 1882	4.8
Do	Aug. 27, 1882	5.2
Fort Stockton, Tex	Sept. 5, 1882	6.6
Indianola, Tex	Sept. 6, 1882	4.0
San Antonio, Tex	do	6.2
Millen, Ga	Sept. 7, 1882	4.3
Savannah, Ga	do	4.9
Troy, Ala	Sept. 9, 1882	9.3
Fort Barrancas, Fla	Sept. 9, 1882	7.4
Pensacola, Fla	do	4.9
Port Eads, La	do	5.9
Cedar Keys, Fla	Sept. 10, 1882	4.1
Allapaha, Ga	do	7.0
Athens, Ga	Sept. 10, 1882	4.4
Eastman, Ga	do	4.6
Macon, Ga	do	6.5
Madison, Ga	do	5.3
Smithville, Ga	do	8.0
Cape May, N. J	Sept. 11, 1882	4.8
New Haven, Conn	Sept. 12, 1882	4.3
New London, Conn	do	4.4
Acto, N. J	do	5.0
Barnegat City, N. J	do	9.5
Little Egg Harbor, N. J	Sept. 12, 1882	4.1
Sandy Hook, N. J	do	4.8
Vineland, N. J	do	6.1
Mount Washington, N. H	Sept. 15, 1882	5.1
Sour Lake, Tex	Sept. 16, 1882	6.1
Patterson, N. J	Sept. 22–24, '82	17.9
Sandy Hook, N. J	Sept. 22, 1882	4.4
West Point, N. Y	do	5.8
Philadelphia, Pa	do	4.6
Bordentown, N. J	Sept. 23, 1882	7.4

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Freehold, N. J	Sept. 23, 1882	6.0
Moorestown, N. J	do	7.0
Readington, N. J	Sept. 21–23, '82	9.0
Somerville, N. J	Sept. 23, 1882	7.7
South Orange, N. J	Sept. 23, 1882	7.5
Albany, N. Y	Sept. 23, 1882	4.2
New York City, N. Y	do	6.2
Fallsington, Pa	do	4.9
West Chester, Pa	do	4.5
Pequannock, N. J	Sept. 24, 1882	9.9
Flushing, N. Y	Sept. 24, 1882	5.3
Norfolk, Va	Sept. 26, 1882	4.2
Wellington, Kans	Oct. 7, 1882	4.2
Wilmington, N. C	Oct. 10, 1882	4.2
Live Oak, Fla	Oct. 11, 1882	4.8
Hatteras, N. C	Oct. 11, 1882	4.7
Fort Macon, N. C	Oct. 12, 1882	5.3
Portsmouth, N. C	do	5.7
Southport, N. C	do	7.4
Charleston, S. C	Oct. 12, 1882	4.2
Somerset, Mass	Oct. 14, 1882	4.5
Dallas, Tex	Oct. 16, 1882	4.0
Shreveport, La	Oct. 17, 1882	4.1
Palestine, Tex	Oct. 18, 1882	4.6
Fernandina, Fla	Oct. 21, 1882	13.1
Allapaha, Ga	Oct. 21, 1882	5.0
St. Augustine, Fla	Oct. 23, 1882	11.5
Mobile, Ala	Oct. 31, 1882	5.2
Nashua, Iowa	Nov. 11, 1882	4.8
Traverse City, Mich	do	4.0
Portland, Oregon	Dec. 13, 1882	7.7
Point Pleasant, La	Dec. 19, 1882	13.5
Portland, Oregon	Jan. 6, 1883	6.9
Hatteras, N. C	Jan. 19, 1883	4.0
Little Rock, Ark	Apr. 6, 1883	4.6
Vicksburg, Miss	Apr. 6, 1883	4.2
New Orleans, La	Apr. 8, 1883	9.2
Norfolk, Va	Apr. 17, 1883	5.2
Nashville, Tenn	Apr. 22, 1883	5.0
Charleston, S. C	May 2, 1883	6.4
Key West, Fla	May 11, 1883	4.8
Mobile, Ala	May 29, 1883	5.6
Wilmington, N. C	June 2, 1883	5.2
Allendale, S. C	June 7, 1883	4.0
Salisbury, N. C	June 10, 1883	7.4
Jesup, Ga	June 13, 1883	4.0
Quitman, Ga	do	4.1
Houston, Tex	do	4.0
Battle Creek, Mich	June 25, 1883	4.8
Fallston, Md	June 27, 1883	4.2

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Ames, Iowa	July 4, 1883	4.5
White, Tenn	July 6, 1883	5.0
Luling, Tex	July 7, 1883	4.0
White, Tenn	July 8, 1883	8.1
Cresco, Iowa	July 21, 1883	4.3
White, Tenn	July 25, 1883	5.1
Calera, Ala	Aug. 2, 1883	4.9
Fallsington, Pa	...do	4.5
Griffin, Ga	Aug. 8, 1883	10.4
Savannah, Ga	...do	4.0
Charleston, S. C	Aug. 8, 1883	4.9
Lincoln, Nebr	Aug. 11, 1883	6.5
Lumberton, N. C	...do	6.2
Lincoln, Nebr	Aug. 17, 1883	4.2
Yemassee, S. C	Aug. 18, 1883	5.0
Ruggles, Ohio	Sept. 1, 1883	4.5
Brownsville, Tex	Sept. 4, 1883	5.8
Houston, Tex	Sept. 7, 1883	5.1
Wilmington, N. C	Sept. 10, 1883	7.3
Lumberton, N. C	Sept. 11, 1883	6.2
New River Inlet, N. C	Sept. 11, 1883	5.9
Scott Hill, N. C	...do	6.8
Southport, N. C	...do	5.2
Weldon, N. C	...do	4.2
Cape May, N. J	Sept. 12, 1883	4.2
Fort Stockton, Tex	Sept. 13, 1883	4.3
Wilmington, N. C	Sept. 14, 1883	4.9
Brookhaven, Miss	Sept. 18, 1883	4.1
Scott Hill, N. C	Sept. 19, 1883	4.0
Fort Stockton, Tex	Sept. 19, 1883	7.9
Luling, Tex	Sept. 20, 1883	4.0
Wellsburg, W. Va	...do	4.5
Memphis, Tenn	Oct. 4, 1883	4.3
Fernandina, Fla	Oct. 17, 1883	5.3
Jacksonville, Fla	...do	4.2
Clay Center, Kans	Oct. 17, 1883	4.7
Brookhaven, Miss	Oct. 18, 1883	4.1
Key West, Fla	Oct. 21, 1883	9.2
Clinton, Ind	Oct. 28, 1883	4.5
Frankfort, Ky	Oct. 29, 1883	6.2
Grand Junction, Tenn	Oct. 29, 1884	5.0
Morrison, Ill	Nov. 5, 1883	4.1
Shreveport, La	Nov. 10, 1883	4.8
Palestine, Tex	...do	5.1
Vicksburg, Miss	Nov. 11, 1883	4.8
Louisville, Ill	Nov. 21, 1883	4.2
McLeansboro, Ill	Nov. 21, 1883	4.2
Franklin, Ind	...do	4.2
Vicksburg, Miss	Nov. 22, 1883	4.0
Tatoosh Island, Wash	Nov. 29, 1883	4.1

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Mackinaw City, Mich	Dec. 21, 1883	4.5
Lynchburg, Va	Dec. 22, 1883	4.5
Fort Gaston, Cal	Dec. 25, 1883	6.6
Vicksburg, Miss	Dec. 30, 1883	4.5
Tatoosh Island, Wash	Jan. 11, 1884	4.1
Tatoosh Island, Wash	Jan. 12, 1884	4.0
San Buenaventura, Cal	Feb. 5, 1884	9.6
Fort Smith, Ark	Feb. 11, 1884	5.6
Pensacola, Fla	Mar. 5, 1884	4.0
Weatherford, Tex	May 1, 1884	4.0
Northport, Mich	May 2, 1884	4.8
Prescott, Ark	May 3, 1884	4.0
Hempstead, Tex	do	4.6
Houston, Tex	do	5.5
Palestine, Tex	do	5.0
Tyler, Tex	May 3, 1884	4.0
Weatherford, Tex	do	4.0
Omaha, Nebr	May 5, 1884	10.0
Northport, Mich	May 13, 1884	4.6
Weatherford, Tex	May 16, 1884	4.9
Weatherford, Tex	May 20, 1884	4.8
Shreveport, La	May 21, 1884	5.4
Palestine, Tex	do	4.4
Tyler, Tex	do	4.0
Weatherford, Tex	May 21, 1885	8.0
Tyler, Tex	May 22, 1884	4.0
Florence, S. C	May 26, 1884	4.0
Cleburne, Tex	June 2, 1884	6.0
Weatherford, Tex	do	4.0
Do	June 3, 1884	5.0
New Haven, Conn	June 26, 1884	4.7
New London, Conn	do	6.0
Voluntown, Conn	do	4.5
Haverford, Pa	do	4.8
Hulmeville, Pa	do	4.8
Athens, Ga	July 4, 1884	4.0
Hatteras, N. C	July 11, 1884	4.2
Smithville, Ga	July 12, 1884	7.5
Leavenworth, Kans	July 14, 1884	4.3
Columbus, Miss	July 28, 1884	4.3
Cresco, Iowa	Aug. 2, 1884	4.7
St. Vincent, Minn	do	4.5
Madison, Iowa	Aug. 27, 1884	4.5
Denmark, Iowa	Aug. 28, 1884	5.6
Fort Barrancas, Fla	Sept. 2, 1884	5.3
La Crosse, Wis	Sept. 6, 1884	5.7
Rio Grande City, Tex	Sept. 10, 1884	5.6
Statesburg, S. C	Sept. 11, 1884	6.4
Charlotte, N. C	Sept. 12, 1884	6.6
Portsmouth, N. C	do	7.0

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Wilmington, N. C	Sept. 12, 1884	6.8
Charleston, S. C	...do	5.4
Fort Macon, N. C	Sept. 13, 1884	5.5
New River Inlet, N. C	...do	8.4
Independence, Iowa	Sept. 23, 1884	7.5
Topeka, Kans	Sept. 27, 1884	4.0
North Lewisburg, Ohio	Sept. 28, 1884	5.4
Indianola, Tex	...do	7.0
Texarkana, Ark	Sept. 29, 1884	4.6
Davenport, Iowa	Oct. 7, 1884	4.1
Franklin, La	Oct. 26, 1884	4.1
New Iberia, La	...do	5.8
Whiteville, La	...do	5.3
Galveston, Tex	...do	5.1
Fort Brown, Tex	Oct. 27, 1884	5.0
Brownsville, Tex	Oct. 28, 1884	4.9
Kitty Hawk, N. C	Nov. 16, 1884	4.0
Wellsboro, Pa	Nov. 23, 1884	5.5
Northport, Mich	Nov. 25, 1884	5.2
Princeton, Mass	Dec. 7, 1884	4.8
Point Pleasant, La	Dec. 14, 1884	5.0
San Rafael, Cal	Dec. 21, 1884	11.4
Point Pleasant, La	...do	4.0
Lynchburg, Va	...do	6.7
San Rafael, Cal	Dec. 26, 1884	7.7
Little Rock, Ark	Dec. 28, 1884	4.6
Shreveport, La	...do	4.1
Galveston, Tex	...do	4.5
Vicksburg, Miss	Dec. 29, 1884	4.1
Mount Ida, Ark	Dec. 30, 1884	10.4
Monroe, La	Dec. 30, 1884	12.1
Point Pleasant, La	...do	8.0
Shreveport, La	Jan. 13, 1885	5.7
Shreveport, La	Jan. 14, 1885	4.3
Lynchburg, Va	Jan. 23, 1885	6.3
Poiht Pleasant, La	Apr. 2, 1885	6.0
Fort Barrancas, Fla	Apr. 3, 1885	4.3
Point Pleasant, La	Apr. 5, 1885	12.3
Vicksburg, Miss	Apr. 7, 1885	4.3
Fort Smith, Ark	Apr. 22, 1885	4.3
Rio Grande City, Tex	May 8, 1885	4.4
Weimer, Tex	May 20, 1885	4.7
Waco, Tex	May 25, 1885	4.4
Malvern, Ark	May 26, 1885	4.0
Greenville, Ala	May 30, 1885	5.8
Dalton, Ga	June 7, 1885	4.1
Hardeeville, S. C	June 9, 1885	5.5
Batesburg, S. C	June 10, 1885	4.1
Jacksonville, Fla	June 11, 1885	5.1
Brownsville, Tenn	June 12, 1885	4.5

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Fort Reno, Ind. T	June 24, 1885	4.0
Salisbury, N. C	June 25, 1885	7.1
Baltimore, Md	June 25, 1885	4.5
Fort McHenry, Md	do	4.1
Lamar, Mo	July 3, 1885	4.4
Cedar Keys, Fla	July 15, 1885	4.5
Wilton Creek, Ill	Aug. 2, 1885	5.2
Chicago, Ill	Aug. 3, 1885	6.3
Fallston, Md	do	6.0
Quakertown, Pa	do	4.1
New Haven, Conn	Aug. 4, 1885	4.5
Buckfield, Me	Aug. 13, 1885	5.8
Amana, Iowa	Aug. 24, 1885	4.4
Clinton, Iowa	do	5.3
New London, Conn	Aug. 25, 1885	4.1
Wellsboro, Pa	Aug. 25, 1885	5.6
Charleston, S. C	Aug. 26, 1885	4.3
Atlanta, Ga	Aug. 30, 1885	4.2
Savannah, Ga	Aug. 31, 1885	4.7
Way Cross, Ga	do	4.0
Charleston, S. C	Aug. 31, 1885	5.9
Hardeeville, S. C	do	6.0
Galveston, Tex	Sept. 4, 1885	7.1
Edwards, Miss	Sept. 5, 1885	4.9
Jackson, Miss	do	4.9
Lamar, Mo	Sept. 7, 1885	7.0
Elk Falls, Kans	Sept. 11, 1885	4.0
Hearne, Tex	Sept. 17, 1885	4.5
Galveston, Tex	Sept. 19, 1885	4.7
Jacksonville, Fla	Sept. 20, 1885	4.0
West Point, Ga	Sept. 20, 1885	4.7
Galveston, Tex	do	4.3
Mayport, Fla	Sept. 21, 1885	9.5
Griffin, Ga	do	5.8
Milledgeville, Ga	do	4.4
Fort Macon, N. C	Sept. 21, 1885	6.0
Hatteras, N. C	do	5.6
Southport, N. C	do	6.5
Wilmington, N. C	do	4.8
Kitty Hawk, N. C	Sept. 22, 1885	4.6
New River Inlet, N. C	Sept. 22, 1885	5.3
Merritt's Island, Fla	Sept. 26, 1885	4.4
Jesup, Ga	Sept. 27, 1885	7.8
Jacksonville, Fla	Sept. 28, 1885	10.3
Mayport, Fla	Sept. 29, 1885	13.7
Mount Carmel, Ill	Sept. 29, 1885	4.0
Reidsville, N. C	Oct. 2, 1885	4.0
Brownsville, Tex	Oct. 8, 1885	4.3
Sanford, Fla	Oct. 10, 1885	6.1
Fort Brown, Tex	do	5.6

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Mayport, Fla	Oct. 11, 1885	5.0
Jesup, Ga	....do	5.7
Reidsville, N. C	....do	4.0
Wilmington, N. C	....do	4.5
Savannah, Ga	Oct. 12, 1885	4.8
Flat Rock, N. C	Oct. 12, 1885	4.1
Charleston, S. C	....do	5.0
Variety Mills, Va	Oct. 13, 1885	4.0
Longview, Tex	Oct. 18, 1885	4.0
Reidsville, N. C	Oct. 19, 1885	4.1
Reidsville, N. C	Oct. 20, 1885	6.0
Galveston, Tex	Oct. 24, 1885	4.2
Longview, Tex	Oct. 26, 1885	6.1
Reidsville, N. C	Oct. 28, 1885	6.0
Dale Enterprise, Va	Oct. 29, 1885	4.8
Variety Mills, Va	Oct. 29, 1885	4.0
Greensboro, Ala	Nov. 7, 1885	6.0
Marion, Ala	....do	7.0
Pensacola, Fla	Nov. 8, 1885	4.8
Reidsville, N. C	Nov. 8, 1885	5.0
Red Bluff, Cal	Nov. 9, 1885	5.9
Sacramento, Cal	Nov. 17, 1885	4.3
San Luis Obispo, Cal	Nov. 18, 1885	10.0
Jacksonville, Fla	Dec. 10, 1885	4.4
Mobile, Ala	Dec. 13, 1885	4.2
Pensacola, Fla	Dec. 13, 1885	4.2
Fort Mason, Cal	Dec. 20, 1885	4.6
New London, Conn	Feb. 12, 1886	6.7
Boston, Mass	....do	4.4
Block Island, R. I	....do	4.5
Atlanta, Ga	Mar. 29, 1886	7.4
Augusta, Ga	....do	4.8
Chattanooga, Tenn	Mar. 30, 1886	7.6
Knoxville, Tenn	....do	5.6
Mahanoy Plane, Pa	May 8, 1886	4.0
Charlotte, N. C	May 18, 1886	4.8
Toccoa, Ga	May 19, 1886	4.0
Anderson, S. C	....do	5.1
Greenville, S. C	....do	4.0
Spartanburg, S. C	....do	5.5
Columbia, S. C	May 20, 1886	6.9
Brownsville, Tex	June 3, 1886	4.6
Alexandria, La	June 15,16,'86	21.4
Aberdeen, Miss	June 21, 1886	5.4
Yemassee, S. C	June 25, 1886	5.0
Cheneyville, La	June 15,16,'86	13.3
Wilmington, N. C	June 30, 1886	4.7
Bainbridge, Ga	July 1, 1886	4.2
Eastman, Ga	....do	6.0
Hatteras, N. C	....do	4.0

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount
		Inches.
Weldon, N. C	July 5, 1886	4.8
Wilmington, N. C	July 15, 1886	7.3
Gorham, Kans	July 24, 1886	6.5
Ninnescah, Kans	do	7.0
Denmark, Iowa	Aug. 13, 1886	4.2
Washington, Ga	Aug. 18, 1886	4.2
Lumberton, N. C	Aug. 19, 1886	4.4
San Antonio, Tex	Aug. 21, 1886	4.5
Rockford, Ill	Aug. 28, 1886	5.3
Independence, Kans	Sept. 4, 1886	4.8
Mount Angel, Oregon	Sept. 5, 1886	5.2
Austin, Tex	Sept. 12, 1886	5.7
Hearne, Tex	Sept. 13, 1886	4.0
Tuscumbia, Ala	Sept. 14, 1886	4.7
Pine Bluff, Ark	do	5.0
Pana, Ill	Sept. 16, 1886	4.5
Brownsville, Tex	Sept. 21, 1886	10.3
Do	Sept. 22, 1886	11.9
Sidney, Ohio	Sept. 23, 1886	5.6
Houston, Tex	Sept. 24, 1886	4.9
Palestine, Tex	Sept. 24, 1886	4.4
Mount Angel, Oregon	Sept. 25, 1886	11.9
Martinsville, Ill	Sept. 28, 1886	5.2
Sour Lake, Tex	Oct. 13, 1886	6.8
Manchester, Iowa	Oct. 14, 1886	6.7
Atlantic City, N. J	Oct. 30, 1886	6.0
Onawa, Iowa	Nov. 17, 1886	4.5
Covington, Tenn	Nov. 21, 1886	4.0
Tatoosh Island, Wash	Dec. 12, 1886	4.0
Mobile, Ala	Feb. 20, 1887	4.2
Marion, Ill	Mar. 5, 1887	4.0
Marengo, Ind	Apr. 22, 1887	6.8
Longview, Tex	May 3, 1887	4.0
Tyler, Tex	do	4.1
Okolona, Miss	May 4, 1887	7.5
Weldon, N. C	May 10, 1887	6.0
Cuero, Tex	May 29, 1887	5.5
Galveston, Tex	June 13, 1887	4.3
Brownsville, Tex	June 20, 1887	4.4
Do	June 21, 1887	4.0
Savannah, Ga	June 27, 1887	6.1
Natchez, Miss	June 28, 1887	4.0
Pensacola, Fla	June 29, 1887	10.7
New Orleans, La	June 30, 1887	5.6
Johnsontown, Va	July 23, 1887	4.2
Manchester, N. H	July 24, 1887	5.2
North Colebrook, Conn	do	4.3
Opelika, Ala	July 27, 1887	5.7
Bainbridge, Ga	do	4.2
Opelika, Ala	July 28, 1887	5.5

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Newnan, Ga	July 28, 1887	5.7
West Point, Ga	do	4.4
Camak, Ga	July 29, 1887	5.2
Union Point, Ga	do	10.0
Washington, Ga	do	6.3
Union Point, Ga	July 30, 1887	4.1
Nashua, Iowa	do	4.1
Germantown, Pa	July 31, 1887	4.4
Gainesville, Ga	Aug. 1, 1887	4.5
Toccoa, Ga	Aug. 1, 1887	4.0
Lincolnton, N. C	Aug. 1, 1887	4.7
Toccoa, Ga	Aug. 2, 1887	4.5
Woods Holl, Mass	do	6.9
New Brunswick, N. J	do	4.6
Statesville, N. C	do	6.5
Wilmington, N. C	Aug. 3, 1887	5.1
Goldsboro, N. C	Aug. 27, 1887	4.0
Raleigh, N. C	do	4.2
Corsicana, Tex	Aug. 30, 1887	5.0
Dallas, Tex	do	4.0
Waco, Tex	Aug. 30, 1887	4.5
Genoa, Nebr	Sept. 1, 1887	10.6
Merritt Island, Fla	Sept. 3, 1887	5.0
Sac City, Iowa	Sept. 5, 1887	5.7
Little Egg Harbor, N. J	Sept. 12, 1887	4.0
St. Marys, Ga	Sept. 17, 1887	6.2
St. Augustine, Fla	Sept. 19, 1887	4.0
Brownsville, Tex	Sept. 21, 1887	8.5
Corpus Christi, Tex	Sept. 24, 1887	4.0
Mobile, Ala	Sept. 27, 1887	4.6
Mount Vernon, Ala	Sept. 27, 1887	4.4
Fostoria, Tenn	do	4.0
Fort McDowell, Ariz	Sept. 30, 1887	4.1
Fort Reno, Ind. T	Oct. 8, 1887	5.6
Fort Sill, Ind. T	do	5.4
Wellington, Kans	Oct. 8, 1887	6.1
Brownsville, Tex	Oct. 11, 1887	6.1
Hazlehurst, Miss	Oct. 17, 1887	6.0
Do	Oct. 18, 1887	4.0
Lumberton, N. C	do	4.2
Biloxi, Miss	Oct. 19, 1887	4.6
Natchez, Miss	do	10.4
Brownsville, Tex	Oct. 21, 1887	4.3
Fort Robinson, Nebr	Oct. 23, 1887	7.1
Florence, Ala	Oct. 25, 1887	4.0
Union Point, Ga	Oct. 26, 1887	4.0
Bainbridge, Ga	Oct. 27, 1887	4.3
Neah Bay, Wash	do	5.8
Tatoosh Island, Wash	do	4.5
Raleigh, N. C	Oct. 31, 1887	4.5

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Raleigh, N. C	Nov. 1, 1887	4.5
Mattoon, Ill	Nov. 26, 1887	5.1
Vandalia, Ill	...do	5.0
Charleston, Ill	Nov. 27, 1887	5.2
Trinity, Ala	Dec. 4, 1887	5.2
Fort Barancas, Fla	Dec. 4, 1887	5.4
Yaquina light-house, Oregon	Dec. 6, 1887	8.5
Neah Bay, Wash	Dec. 17, 1887	5.4
Palestine, Tex	Mar. 4, 1888	5.8
Pensacola, Fla	Mar. 10, 1888	4.0
Biloxi, Miss	...do	4.5
Brattleboro, Vt	Mar. 12, 1888	4.0
Neah Bay, Wash	...do	4.0
Pysht, Wash	...do	4.0
South Orange, N. J	Mar. 13, 1888	5.0
Lawrenceburg, Tenn	Mar. 26, 1888	4.7
Auburn, Ala	Mar. 27, 1888	4.8
Gadsden, Ala	...do	4.8
Montgomery, Ala	...do	7.2
Talledega, Ala	...do	9.2
Troy, Ala	Mar. 27, 1888	4.5
Union Springs, Ala	...do	6.2
Nunelly, Tenn	...do	4.0
Statesville, N. C	Mar. 29, 1888	4.0
Santa Maria, Tex	Apr. 20, 1888	7.3
McAllaster, Kans	Apr. 26, 1888	4.0
Grainfield, Kans	Apr. 27, 1888	5.0
Dallas, Tex	...do	5.0
Weatherford, Tex	Apr. 28, 1888	5.0
Palestine, Tex	Apr. 29, 1888	4.4
St. Matthews, S. C	May 10, 1888	4.0
Hatteras, N. C	May 11, 1888	4.8
Tallahassee, Fla	May 20, 1888	6.3
Fort Niobrara, Nebr	May 26, 1888	5.0
Hot Springs, Ark	May 28, 1888	5.5
Malvern, Ark	May 28, 1888	4.9
Alexandria, La	May 30, 1888	4.2
Fort Monroe, Va	May 31, 1888	4.1
Alva, Fla	June 15, 1888	4.5
St. Louis, Mo	June 16, 1888	4.6
Columbia, Tex	June 17, 1888	7.0
Galveston, Tex	...do	6.4
New Ulm, Tex	June 18, 1888	6.5
Orange, Tex	...do	4.5
Sour Lake, Tex	...do	9.7
Cunningham, Kans	June 19, 1888	4.0
Fort Maginnis, Mont	June 21, 1888	5.3
New Orleans, La	June 26, 1888	4.4
Evergreen, Ala	June 27, 1888	5.5
Mobile, Ala	...do	8.6

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Mount Vernon Barracks, Ala	June 27, 1888	4.5
Mattoon, Ill	do	5.8
Pana, Ill	do	4.0
Windsor, Ill	do	4.0
Port Eads, La	do	4.0
Gove, Kans	July 2, 1888	4.0
Osceola, Iowa	July 4, 1888	4.8
Cromwell, Iowa	July 5, 1888	6.5
Orange, Tex	July 6, 1888	5.5
Piatt, Ill	July 8, 1888	4.7
Gracey, Ohio	July 8, 1888	5.0
Philo, Ill	July 9, 1888	8.1
Connersville, Ind	do	6.8
Gracey, Ohio	do	7.0
Newcomerstown, Ohio	July 9, 1888	4.0
Tridelphia, W. Va	July 19, 1888	6.9
Woods Holl, Mass	July 22, 1888	4.4
Denmark, Iowa	July 27, 1888	4.8
Charleston, S. C	July 30, 1888	4.3
Phillips, Wis	Aug. 3, 1888	4.0
Detroit, Mich	Aug. 4, 1888	4.4
Mandeville, La	Aug. 8, 1888	8.5
Spartanburg, S. C	Aug. 10, 1888	6.0
Cromwell, Iowa	Aug. 11, 1888	5.5
Glenwood, Iowa	do	5.0
Smithville, N. C	Aug. 13, 1888	5.5
Baton Rouge, La	Aug. 15, 1888	4.2
Port Eads, La	do	5.7
St. Joseph, La	do	6.0
Sugar Experiment Station, La	do	4.0
Thibodeaux, La	Aug. 15, 1888	4.2
St. Martinville, La	Aug. 19, 1888	5.4
Dallas, Tex	do	4.0
Citronelle, Ala	Aug. 20, 1888	4.0
New Market, Ala	do	4.0
Clinton, La	Aug. 20, 1888	4.8
Franklinton, La	do	4.1
New Orleans, La	Aug. 28, 1888	8.9
Selma, Ala	Aug. 21, 1888	5.0
Blue Lick, Ind	do	4.1
Aberdeen, Miss	Aug. 21, 1888	7.5
Locktown, N. J	do	4.0
Paterson, N. J	Aug. 22, 1888	4.4
Plainfield, N. J	do	5.7
South Orange, N. J	Aug. 21, 1888	4.2
Union, N. J	Aug. 21, 1888	4.0
West Point, N. Y	do	4.3
Demos, Ohio	do	4.2
Gracey, Ohio	do	4.0
Bethlehem, Pa	do	4.5

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Girardville, Pa	Aug. 21, 1888	5.6
Huntingdon, Pa	do	4.8
Johnstown, Pa	do	4.5
Kutztown, Pa	do	5.1
Lebanon, Pa	do	4.8
New Bloomfield, Pa	Aug. 21, 1888	4.8
Point Pleasant, Pa	do	4.0
Seisholtzville, Pa	do	4.7
Selin's Grove, Pa	do	5.2
Shamokin, Pa	do	4.0
Somerset, Pa	Aug. 21, 1888	4.5
State College, Pa	do	4.0
Uniontown, Pa	do	4.5
Memphis, Tenn	do	4.7
Frankfort, Ky	Aug. 22, 1888	4.0
Maurepas, La	Aug. 22, 1888	7.8
Ardenia, N. Y	do	4.0
Altoona, Pa	do	4.3
Harrisburg, Pa	do	4.7
Quakertown, Pa	do	4.6
Reading, Pa	Aug. 22, 1888	4.5
Dallas, Tex	Aug. 24, 1888	4.0
Galvestion, Tex	do	5.9
Gallinas, Tex	Aug. 25, 1888	5.0
San Antonio, Tex	do	4.2
Granbury, Tex	Aug. 26, 1888	10.2
Mesquite, Tex	do	4.4
Weatherford, Tex	do	5.8
Malvern, Ark	Aug. 28, 1888	4.2
Tyler, Tex	do	11.4
Biloxi, Miss	Aug. 30, 1880	4.5
Eufaula, Ala	Aug. 30, 1880	4.2
Ashwood, Tenn	Aug. 31, 1888	5.4
Gainesville, Ga	Sept. 5, 1888	4.3
Livingston, Ala	Sept. 7, 1888	4.2
Alva, Fla	Sept. 8, 1888	6.7
Manatee, Fla	Sept. 9, 1888	5.0
Albany, Ga	do	5.2
Camak, Ga	do	4.5
Milledgeville, Ga	do	5.5
Union Point, Ga	Sept. 9, 1888	4.4
Washington, Ga	do	4.0
Oceanic, N. J	do	4.5
Jacksonboro, S. C	do	4.0
Statesville, N. C	Sept. 10, 1888	5.3
Abbeville, S. C	Sept. 10, 1888	7.4
Greenwood, S, C	do	8.4
New Market, Ala	Sept. 14, 1888	4.8
Eastman, Ga	do	4.0
Atlanta, Ga	Sept. 16, 1888	5.9

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Millersburg, Ky	Sept. 16, 1888	4.6
Statesville, N. C	...do	4.1
Lincoln, Wis	...do	4.0
Ardenia, N. Y	Sept. 17, 1888	4.3
Bethlehem, Pa	...do	4.7
Spartanburg, S. C	Sept. 17, 1888	4.0
Green Bay, Wis	...do	4.0
Boyd Corners, N. Y	Sept. 18, 1888	5.0
Cotuit, Mass	Sept. 26, 1888	4.7
New Bedford, Mass	...do	4.8
Taunton, Mass	Sept. 26, 1888	4.3
Vineyard Haven, Mass	...do	6.0
Wood's Holl, Mass	...do	6.6
Austin, Tex	Oct. 21, 1888	4.0
New Orleans, La	Oct. 22, 1888	4.1
Marengo, Ind	Nov. 2, 1888	4.0
Corpus Christi, Tex	Nov. 7, 1888	4.6
Little Rock, Ark	Nov. 8, 1888	4.4
Archer, Fla	Nov. 9, 1888	4.1
Manatee, Fla	Nov. 10, 1888	4.5
Titusville, Fla	Nov. 10, 1888	4.1
Milton, Mass	Nov. 27, 1888	6.2
Fort Meade, Fla	Dec. 17, 1888	6.2
Homeland, Fla	...do	4.1
Merritt's Island, Fla	...do	5.4
Titusville, Fla	Dec. 17, 1888	5.3
Ardenia, N. Y	...do	4.0
Hartford, Conn	Dec. 18, 1888	4.2
Fallston, Md	...do	5.0
Micco, Fla	Dec. 24, 1888	6.3
Jupiter, Fla	Jan. 12, 1889	6.4
Hepzibah, Ga	Jan. 20, 1889	6.0
St. Martinville, La	Jan. 26, 1889	4.0
Motes, Ala	Feb. 16, 1889	4.0
Statesville, N. C	Feb. 18, 1889	4.5
Camp Peña Colo., Tex	Feb. 27, 1889	4.5
Fort Barrancas, Fla	Mar. 2, 1889	4.0
Viola, Del	Mar. 5, 1889	5.0
Smithfield, Va	Mar. 20, 1889	4.2
Birdsnest, Va	Apr. 7, 1889	4.0
Spottsville, Va	Apr. 7, 1889	4.0
Hatteras, N. C	Apr. 16, 1889	4.4
Norfolk, Va	...do	4.6
Beardstown, Ill	Apr. 19, 1889	4.0
Washington Barracks, D. C	Apr. 25, 1889	5.4
Kendall Green, D. C	Apr. 26, 1889	5.5
Washington City	...do	4.7
Baltimore, Md	...do	5.8
Fort McHenry, Md	...do	5.0
Jewell, Md	Apr. 27, 1889	7.5

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Hanover, N. J	Apr. 27, 1889	4.6
Fort Myer, Va	...do	5.3
Seisholtzville, Pa	Apr. 28, 1889	4.7
Luray, Kans	May 13, 1889	4.0
Junction City, Kans	May 17, 1889	4.1
Wakefield, Kans	May 17, 1889	4.2
Princeton, Mo	May 18, 1889	4.4
Barren Creek Springs, Md	May 20, 1889	4.1
Lebo, Kan	May 28, 1889	4.6
Booneville, Mo	May 29, 1889	4.4
New Frankfort, Mo	May 29, 1889	9.0
Withers Mill, Mo	...do	4.0
Gainesville, Ga	May 30, 1889	4.8
Butlerville, Ind	...do	4.0
Asheville, N. C	...do	4.2
Lenoir, N. C	May 30, 1889	4.1
Morganton, N. C	...do	5.0
Wauseon, Ohio	...do	6.0
Frederick, Md	May 31, 1889	5.2
Chapel Hill, N. C	...do	4.1
Friendship, N. Y	May 31, 1889	5.5
Savona, N. Y	...do	4.6
West Almond, N. Y	...do	6.0
Aqueduct, Pa	...do	5.7
Blue Knobb, Pa	...do	7.9
Charlesville, Pa	May 31, 1889	6.7
Coudersport, Pa	...do	5.4
Eagles Mere, Pa	...do	5.2
Emporium, Pa	...do	5.9
Grampian Hills, Pa	...do	8.4
Harrisburg, Pa	May 31, 1889	6.2
Hollidaysburg, Pa	...do	5.1
Huntingdon, Pa	...do	4.2
McConnellsburg, Pa	...do	7.1
Petersburg, Pa	...do	6.6
Selin's Grove, Pa	May 31, 1889	6.0
Smethport, Pa	...do	5.5
Somerset, Pa	...do	4.4
Tuscarora, Pa	...do	5.8
Florence, S. C	...do	4.9
Alum Springs, Va	May 31, 1889	5.5
Bolar, Va	...do	6.2
Dale Enterprise, Va	...do	5.2
Fort Myer, Va	...do	4.9
Crowley, La	June 6, 1889	5.6
Philo, Ill	June 7, 1889	4.2
New Frankfort, Mo	June 8, 1889	4.6
Peoria, Ill	...do	4.1
Coventry, Vt	June 9, 1889	4.8
Cheneyville, La	June 10, 1889	5.9

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Luling, Tex	June 10, 1889	4.0
Lampasas, Tex	June 12, 1889	4.3
Memphis, Tenn	June 13, 1889	4.1
Fort Scott, Kans	June 16, 1889	6.4
Marmaton, Kans	do	6.6
Alexandria, La	June 19, 1889	4.7
Merritts Island, Fla	June 23, 1889	5.3
Diamond, Ga	June 27, 1889	4.2
Madison Barracks, N. Y	do	4.2
Tannersville, N. Y	do	5.0
Hot Springs, Ark	June 29, 1889	4.0
Ellis, Kan	do	4.1
Raleigh, N. C	do	5.2
Spottsville, Va	do	4.1
Marengo, Ind	July 2, 1889	4.2
Diamond, Ga	July 3, 1889	4.1
Dallas, Tex	do	5.0
Fort Worth, Tex	do	6.2
Cleburne, Tex	July 4, 1889	6.0
Fort Clark, Tex	do	4.0
Lumberton, N. C	July 5, 1889	4.5
Fort Clark, Tex	July 10, 1889	5.0
Waynesboro, Pa	July 12, 1889	4.9
Rock Island Arsenal, Ill	July 13, 1889	5.2
Muscatine, Iowa	do	4.1
Sac City, Iowa	July 13, 1889	5.0
Ashwood, Tenn	do	4.4
Davenport, Iowa	July 14, 1889	5.2
Le Claire, Iowa	do	5.0
Denmark, Iowa	July 17, 1889	4.4
Angola, Ind	July 18, 1889	4.5
Colon, Mich	do	4.6
Sturgis, Mich	do	4.9
Logan, Ohio	do	5.5
Point Pleasant, Pa	July 20, 1889	4.0
Smiths Corners, Pa	July 20, 1889	4.4
Belleville, Kans	July 23, 1889	4.1
Burr Oak, Kans	do	4.0
Concordia, Kans	do	5.0
Concordia, Kans	do	4.2
Kirwin, Kans	July 23, 1889	4.3
Manhattan, Kans	do	5.4
Stockton, Kans	do	4.5
Macon, Miss	do	5.0
Independence, Kans	July 24, 1889	4.0
Hepzibah, Ga	July 25, 1889	4.9
Chicago, Ill	July 27, 1889	4.0
Charleston, S. C	do	4.1
Dardanelle, Ark	July 29, 1889	5.0
Russellville, Ark	July 28, 1889	6.0

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Gillette, N. J	July 30, 1889	4.1
Baltimore, Md	July 31, 1889	4.0
Gambrill's, Md	...do	4.2
Lambertville, N. J	...do	4.5
Madison, N. J	...do	4.0
Newark, N. J	July 31, 1889	5.3
Plainfield, N. J	...do	6.6
South Orange, N. J	...do	8.6
Tenafly, N. J	...do	5.2
Union N. J	...do	6.0
Davids Island, N. Y	July 31, 1889	5.2
Forks of Neshaminy, Pa	...do	4.1
Franklin, Pa	...do	4.4
Frederick, Pa	...do	4.6
University of Virginia, Va	...do	4.0
Newport, Ark	Aug. 4, 1889	4.3
Carson, Iowa	Aug. 9, 1889	6.5
Weeping Water, Nebr	...do	5.2
New Braunfels, Tex	...do	5.4
Lawrence, Kans	Aug. 12, 1889	4.0
Crete, Nebr	Aug. 12, 1889	4.4
Tecumseh, Nebr	...do	9.0
Oceanic, N. J	Aug. 14, 1889	5.8
Girardville, Pa	...do	4.0
Nantucket, Mass	Aug. 15, 1889	5.7
Charleston, S. C	Aug. 15, 1889	4.1
Grantsburg, Wis	Aug. 20, 1889	7.8
Lumberton, N. C	Aug. 26, 1889	5.2
Brownsville, Tex	Sept. 2, 1889	5.2
Fort Brown, Tex	...do	4.8
Huntingburg, Ind	Sept. 4, 1889	5.0
College Station, Tex	...do	7.8
Grand Junction, Tenn	Sept. 5, 1889	4.5
Grief, Tenn	...do	4.0
Nunelly, Tenn	...do	4.2
Gainsville, Tex	Sept. 5, 1889	5.0
Emporia, Kans	Sept. 8, 1889	4.0
Forestburg, Tex	...do	5.2
Decatur, Tex	Sept. 10, 1889	4.1
Gainesville, Tex	...do	5.5
Howe, Tex	Sept. 10, 1889	4.2
Lehigh, Ind. Ter	Sept. 11, 1889	5.0
Independence, Kans	...do	5.1
Sedan, Kans	...do	7.5
Washington, Iowa	Sept. 12, 1889	4.9
Freehold, N. J	Sept. 12, 1889	4.1
Moorhead, Minn	Sept. 13, 1889	4.3
Caton, S. Dak	Sept. 14, 1889	4.2
Andersonville, Tenn	Sept. 16, 1889	4.6
Loudon, Tenn	...do	4.2

RAINFALLS IN EXCESS OF FOUR INCHES IN A DAY—Continued.

Locality.	Date.	Amount.
		Inches.
Villa City, Fla	Sept. 18, 1889	4.0
South Ford, Ky	do	7.5
Citronelle, Ala	Sept. 22, 1889	4.0
Key West, Fla	do	7.9
Mount Vernon Barracks, Ala	Sept. 23, 1889	4.1
Jacksonville, Fla	Sept. 23, 1889	4.4
Lake City, Fla	do	4.2
Live Oak, Fla	do	4.5
Fort McPherson, Ga	do	4.0
Bolar, Va	Sept. 24, 1889	4.2
Houma, La	Sept. 25, 1889	5.3
Santa Barbara, Cal	Oct. 20, 1889	4.2
Birdsnest, Va	Oct. 24, 1889	4.2
Key West, Fla	Nov. 9, 1889	4.5
Charleston, S. C	Nov. 17, 1889	5.8
Wellsboro, Pa	Nov. 19, 1889	4.0
Shelton, Conn	Nov. 27, 1889	4.8
Belleville, N. J	do	4.0
Fort Preble, Me	Nov. 28, 1889	4.3
Newburyport, Mass	do	4.1
White Plains, N. Y	Nov. 28, 1889	5.0
Upper Mattole, Cal	Dec. 10, 1889	4.2
Los Angeles, Cal	Dec. 12, 1889	4.3

RIVER DISCHARGES.

(Extracts from reports of Chief of Engineers.)

Castleman's gave the following results:

	Cubic feet per second.
July 21, 1825, at Pleucher	18
July 10, 1825, below Flaugherty	38
July 12, 1826, at its mouth	46
March 21, 1826, at Pleucher dam	98
March 27, 1826, below Flaugherty Creek	715
March 21, 1826, at Forney's milldam	536

Castleman's at its mouth:

July 20, 1825	40
July 20, 1826	46

Laurel Hill Run at its mouth:

July 20, 1825	7
July 20, 1826	26

Youghiogheny above the mouth of Castleman's:

July 21, 1825	70
July 20, 1826	104

The above at low water.

In 1838, in low water, Capt. Sanders called the flow from the Allegheny River 1,333 cubic feet a second, and from the Monongahela 333 cubic feet per second. Once in ten years such a minimum occurs.

The least quantity of water passing in the Great Youghiogheny gave in 1824 under the bridge on the road from Mansfield to Morgantown, September 21, 22.58 feet in a second; the Little Youghiogheny, on September 23, gave at German bridge 4.30 feet.

Ohio River from Pittsburg to Wheeling, 90 miles, is 1,200 feet wide. The discharge at a low stage 2,500 cubic feet per second.

Brounot's Island, 2 miles below Pittsburg. Capt. Sanders, in 1838, found 1,661 cubic feet per second discharges for this place.

The discharge of the Ohio River at Pittsburg is as follows:

Stage.	Cubic feet per second.
0.00	1,666
0.25	3,000
0.50	4,387
1.00	7,274
2.00	13,554

The quantity of water passing in the Ohio at Wheeling Island at the lowest stage in 1868, called 14 inches in the channel, was 3,000 cubic feet per second.

Kanawha River.

[Charleston Pool, 2 miles below the foot of Catfish Shoal.]

No.	Stage above low water.	Cross section, square feet.	Discharge in cubic feet per second.
1	1.55	4,182	2,492
2	2.70	4,877	4,925
3	4.51	5,903	8,613
4	4.70	6,080	8,852
5	6.55	7,370	12,733
6	7.01	7,552	13,605
7	8.36	8,507	18,562
8	10.89	9,939	28,798
9	15.55	13,169	47,120
10	18.96	15,539	58,558
11	22.11	17,710	76,851
12	26.55	20,926	98,407
13	32.85	25,365	118,291
------	34.50	----------------	155,388

The banks of the Kanawha are from 40 to 60 feet above low water.

The discharge of the river at low water in 1838 was 1,100 cubic feet per second. In 1858 the low-water discharge was 1,350 cubic feet.

At Bull River Shoals, Kanawha River, the flow was 12.58 cubic feet per second; at Hays Bar, 8.72 cubic feet per second.

Observations on the Kanawha River discharge in the flood of January 16, 1878, gave 155,388 cubic feet per second, the Charleston gauge reading 34.5 at 11 a.m. and 34.75 at 12:45 p.m. The river reached its highest point, 35.45, at 4:30 p.m.

The Elk was gauged on the afternoon of the same day and the discharge found to be 32,959 cubic feet per second.

The Kanawha discharge below the Elk was 188,347 cubic feet per second. Discharges of small tributaries of Kanawha and James rivers are very small. The largest, Greenbrier River, below the mouth of Howard Creek, 6,650 feet per second.

1822: Highest water in the Kanawha ever known up to that time.
1856-'57: Coldest winter ever known and longest freeze up.
1861: Disastrous flood, highest water ever known.

Year.	Locality.	Cubic feet per second.	Remarks.
1838	Above Charleston	1,350	Ordinary low water.
1838	Below Buffalo	1,100	Extreme low water.
1858	Below Lykins Shoals	1,237	Ordinary low water.
1858	At Buffalo	1,755	Half foot above low water.
	....do	1,350	Reduced to low water.
1858	Below Elk Shoal	8,550	2.1 feet at head and 2.4 at foot.
1858	....do	14,970	3.1 feet at head and 3.7 at foot.
1858	Below Elk Shoal	19,080 to 21,000	3.8 at head and 4.8 at foot of shoal.

The minimum flow of the Greenbrier River at the mouth of Howard Creek, just below Greenbrier Bridge, is 97 cubic feet per second; 16 miles lower down 1,000 feet per second.

On the Greenbrier the maximum freshet rise is about 20 feet. It varies on different portions of New River rarely exceeding 8 feet at Richman Falls; 30 to 35 feet from Stretcher Neck to Bowyer's, or perhaps to Miller's Ferry, and for a few miles below the latter point 40 to 50 feet. At the Blue Hole, where the river having fallen 62 feet in 2 miles, turns at right angles and meets a lighter grade there are signs of a high water of 69 feet.

The discharge of New River when said to be at a low stage, but not its lowest, was found to be 2,000 cubic feet per second.

At Marietta, with 12 feet of water in channel, the discharge is 35,503 cubic feet per second.

At Cincinnati, 7.30 on gauge velocity, 1.125 miles per hour: 24.73 on gauge velocity, 3.200 miles per hour; 34.34 on gauge velocity, 4.301 miles per hour; 43.78 on gauge velocity, 5.843 miles per hour at the Cincinnati Southern Bridge.

OHIO RIVER DISCHARGES AT CINCINNATI.

[Not very accurate. Derived, not observed.]

Stage.	Cross section, square feet.	Velocity feet per second.	Discharge cubic feet per second.
0	6,526	1.65	10,758
7.3	13,106	1.65	21,615
24.7	29,744	4.69	139,293
34.3	42,226	6.31	266,282
43.8	53,392	8.56	457,104
62.5	80,475	9.99	804,750
71.1	88,522	11.00	973,500

The discharges at Cincinnati are derived from the cross section for 62.5 foot stage, as given by the Engineer Board on site of Suspension Bridge, and as based on the current velocities up to the 43.8 feet stage, as given by Board of Engineers on the Cincinnati Southern Railroad Bridge.

The cross sections were interpolated, and the velocities taken as proportional to square root of hydraulic depth. The slopes were considered to be alike at all the high stages, as they would hardly vary enough to produce a change of velocity.

At the railroad bridge over the Ohio River at Bellaire the discharge was 36,261 cubic feet per second when the water stood at the 8.5 marks at Wheeling, 4 miles above. Eight hundred feet above the bridge the cross section was 11,105 feet.

The high-water section at the bridge site is 74,787 square feet, of which 6,735 square feet, or 9 per cent, is occupied by the bridge piers. The low-water section is 3,425 square feet, of which 506, or 15 per cent, is obstructed.

The maximum oscillation at Bellaire is reported as 50 feet, compared with 43.5 at Wheeling.

The section of river 900 feet above the Parkersburg bridge at an 8-foot stage by the gauge on the bridge was 15,676 square feet, and the discharge was 41,058 cubic feet per second. The actual water way on the line of the bridge was 13,749 square feet. The total high-water section at the bridge is 114,854 square feet, of which 11,177, or 10 per cent, is obstructed. The low-water section is 7,271 square feet, of which 608 is obstructed.

STEUBENVILLE BRIDGE.—At low water the natural section of the river is 3,179 square feet, of which 604 is obstructed. At high water the total section is 77,189 square feet, of which 7,342 is obstructed. The approximate discharge 300 feet above the bridge, 9 feet above low water, is 37,858 cubic feet per second.

Suspension bridge at Wheeling destroyed by a tornado May 17, 1854. At low water the bridge occupies no part of the water way. At extreme high water the abutments obstruct 6,137 square feet, which is 14 per cent of the entire section.

At the suspension bridge, Cincinnati, the river at low water has a section of 6,526 square feet, the width being 940 feet. At extreme high water (1832) the section is 80,475 square feet, of which 5,500, or 6½ per cent, is obstructed, this being at the 62.5 feet stage.

At Louisville the total high-water section of river at the bridge is 216,249 square feet, of which 13,573, or 6 per cent, is obstructed. The low-water section is 1,377 square feet, of which 60 square feet is obstructed. At low water the rise below falls is 3 feet for 1 above; when the depth at head of falls is 18 feet the rise is same above as below.

In Licking River the quantity of water the river furnishes was measured above the site of Lock No. 21 on August 1, 1877, at lowest stage and found to be 42 cubic feet per second. Three considerable tributaries enter the river within 10 miles below where the measurement was made, which are estimated to furnish 20 cubic feet per second.

The Kentucky River from its mouth to the mouth of Middle Fork is 258 miles and falls 228 feet. There are locks and dams in the lower part of the river. The discharges in cubic feet per second are as follows:

North or Main Fork:	
Whitesburg	86
Leatherwood Creek	300
Hazard	700
Troulesome Creek	1,700
Jackson	1,700
Middle Fork	20,000
Middle Fork:	
Crockettsville	1,507
Mouth	3,600
South Fork:	
Goose Creek	216
Red Bird	177
Main stream:	
Beattyville	20,000

Kentucky River, discharge for depth of river 25.7 feet at Dam No. 2 (stage 45.3 feet), 101,930 cubic feet per second.

The drainage area of Green River is about 10,000 square miles; its greatest length is 175 miles and width 90 miles.

On the Tradewater River the discharge at low water at Belleville is 73.17 cubic feet per second, 41.15 miles above the mouth; at Montezuma, 10.2 miles below Belleville, 76.51 cubic feet; at Fish Trap, 6.62 miles further down, 110.45 cubic feet; at Commercial, 5.53 miles above the mouth, 347.1 cubic feet. Drainage basin, 60 miles by 20; total area, 827 square miles. The discharge of the French Broad River is 575.107 cubic feet per second.

Cumberland River, at the dam above Dover, when the gauge read 1.9 feet, had a discharge of 3,248 cubic feet per second. The discharge above Flax Patch Dam, when the gauge read 2.2 feet, was 4,971 cubic feet per second, and the discharge near the middle of the island, 4,810.

Cumberland River, at low water above Kentucky and Tennessee State line, 850 cubic feet per second; above the mouth of Caney Fork, 1,110; near Nashville, 1,325.

The Tennessee River at Chattanooga, at low water, is 1,200 feet wide and 8 feet deep. The current is 2 miles an hour.

The fall of Duck River from Columbia to mouth is 213.5 feet, the distance being 125 miles. The Tennessee backs water to Hurricane Creek, 19 miles up Duck River. At 2 feet above low water, a short distance below Centerville, at Pace Island, the discharge is 1,270 cubic feet per second. Below the mouth of Pine River and Beaver Dam Creek the volume of water at mean velocity was 1,187 cubic feet per second, the river being 1 foot above low water.

PADUCAH, KY.

Stage.	Discharge.	Stage.	Discharge.
5	90,000	30	520,000
10	130,000	35	640,000
15	180,000	40	800,000
20	280,000	45	920,000
25	380,000	50	1,200,000

Discharge measurements in cubic feet per second: At Crow Wing River, May 13, 1882, 10,160; at Sauk Rapids, 6.3 feet stage, 21,907; 7.2 feet stage, 27,588; at Fridley Bar, 5 miles above St. Anthony, 6.7 feet stage, 21,610; mean low water, 3,112; at Minneapolis, 1,600 feet above St. Anthony Falls, low water, 2,332. Minnesota River at Fort Snelling, 2.1 feet, St. Paul gauge the discharge is 760 cubic feet.

The Crow Wing, the largest affluent of the Mississippi above the Falls of St. Anthony, drains a country of 3,562 square miles; at low water of 1874 its discharge was 2,699 cubic feet per second.

MISSISSIPPI RIVER.

Locality.	Stage.	Discharge in cubic feet per second.
Frenchman Bar	5.8	20,091
Hastings	4.3	15,332
Foot of Prescott Island	4.5	32,001
Hastings Bar	4.3	15,516
Wabasha	4.5	45,209

St. Croix, 7 miles above Taylor Falls, 1882, maximum of year, 35,775; low water, 2,523. Mississippi River, above Pokegama Falls, drainage area 3,298 square miles.

DISCHARGE OF THE MISSISSIPPI RIVER AT ST. PAUL.

Gauge reading.	Cubic feet per second.	Gauge reading.	Cubic feet per second.
3.0	10,000	17.0	104,000
5.0	15,000	18.0	113,000
7.0	22,000	1.75	6,218
9.0	33,000	1.40	4,295
11.0	45,000	11.00	46,512
13.0	60,000	3.60	3,500
15.0	77,000		

At a stage 3.21 above low water the discharges of the Mississippi River are:

	Cubic feet per second.	Drainage area, square miles.
Prescott	8,598	33,719
Winona	17,712	55,474
Clayton	22,816	74,865
Hannibal	42,600	129,635

Prescott, below the Minnesota and St. Croix rivers.		Winona, below the Chippewa River.		Clayton, below the Wisconsin River.	
Stage.	Discharge.	Stage.	Discharge.	Stage.	Discharge.
178	8,000	434	10,000	2	27,000
182	22,000	438	35,000	6	58,000
186	42,000	442	67,000	10	102,000
190	78,000	446	114,000	14	147,000
				18	180,000

Total area drained by the Wisconsin River, 11,850 square miles; low-water discharge, 4,790 cubic feet per second. Low-water discharge Wisconsin River, cubic feet per second per square mile drained, 0.628.

Discharge at Skinners Bluff on Wisconsin at highest water, about 10 feet is estimated to be 61,200 cubic feet per second.

The low-water discharge at Burlington, Iowa, October 23, 1866, was 36,100, average low water. The low-water discharge in 1864 must have been about 31,913 cubic feet per second, or at least not less than 30,000. The average area of cross section at ordinary low water is 17,550 square feet, mean surface velocity 2.88 feet per second; mean velocity 2.304 gives a discharge of 40,435 cubic feet per second.

HANNIBAL BELOW THE DES MOINES RIVER.

Stage.	Discharge.
72	18,000
76	58,000
80	110,000
84	178,000
88	266,000

The discharge of the Des Moines River April 29, 1867, was 35,000 cubic feet per second, when stage was 2.5 feet below high water of April 24, 1867, on which day the discharge was not less than 42,000 cubic feet per second.

The high water of the Des Moines in 1851 could not have been less than 55,000 cubic feet per second, its height being 7.5 feet above the level of April 24, 1867. On April 27, 1867, a rise of 1 foot corresponded to an increase in the discharge of the Mississippi of about 10,000 cubic feet per second. No great rise can occur in the Des Moines without a corresponding one in the Mississippi. The Des Moines drains 12,600 square miles. The area of the valleys of the other tributaries of the Mississippi in the same latitude is about 40,000 square miles, and the country above would probably contribute as much more water contemporaneous with it. The Des Moines can never form more than one-sixth of any considerable flood in the Mississippi.

At Keokuk, April 27, 1867, when the river stood on the gauge 13.35 feet, the discharge was 195,000 cubic feet per second. On April 24, stage 15.3, the discharge was probably 215,000 cubic feet per second. It is estimated that the high water at Keokuk in 1851 was 265,000 cubic feet per second.

GRAFTON, BELOW THE ILLINOIS RIVER.

Stage.	Discharges.	Stage.	Discharges.
14	27,000	26	189,000
18	72,000	30	270,000
22	126,000	34	354,000

ILLINOIS RIVER DISCHARGES.

Place.	Stage.	Discharge.
		Cubic feet.
Willow Island	1.3	2,788
Copper Creek	1.7	2,509
Spring Lake	1.5	2,527
Frederick	1.3	2,590
Lagrange	4.3	9,746
Naples	3.9	10,366
Bedford	4.0	9,134

The low-water discharge of the Illinois River is less than 2,000 cubic feet per second. The mean discharge of the Upper Mississippi is 105,000 cubic feet per second, and of the Missouri, 120,000.

The Rock River at its lowest known stage, October 11, 1870, was discharging 2,446 cubic feet per second.

At St. Louis, August 4, 1865, stage 12.7 feet above the lowest water, the discharge was 211,073 cubic feet per second; on October 24, with stage of 19.67 feet above low water, it was 384,075 cubic feet per second, in May, 1872, with stage 20.4 feet and river falling, the discharge was 314,859 cubic feet, with mean velocity of 4.49 feet and area 70,124 square feet; May 16 and 17, when the gauge read 21.8 feet above low water of 1863, the river falling at the time, the discharge was 368,747 cubic feet per second, with a mean velocity of 5.005 feet per second and area of 73,664 square feet.

The flood of 1858 carried 700,000 cubic feet per second past St. Louis.

The flood discharge at Quincy (chief engineer of bridge) is 466,740 cubic feet per second; for 12.4 feet above low water, 201,185. Flood of 1844 past St. Louis, 1,200,000 cubic feet per second; flood of 1858, 700,000; 21.8 feet stage, 368,747; 20 feet stage, 315,000; 13 feet stage, 215,000; mean, 225,000; lowest discharge, 36,000.

No destruction in flood of 1841. The high water of 1844 endured the greater part of June and the early part of July. Such a flood as that of 1844 may never again occur on account of the progress of agriculture.

Slope at St. Louis in 4.489 miles at stages from 18 to 36 below city directrix, average of 0.517 feet per mile.

	Feet per mile.
30 below	0.709
30 to 32 below	0.724
32 to 34 below	0.695
34 to 36 below	0.737

Low-water width at St. Louis, 1,520 feet; at high water, 2,000 feet. Great floods in latter part of June. Maximum velocity at 3 feet below the surface varies from 4 feet per second at the lowest stage to 12¼ feet at highest stage, that of 1844.

Section at low water in narrowest part of channel of St. Louis Harbor, 24,971 square feet. At Pittsburg coal dike, just below the bridge, it is 23,395.

At St. Louis, at 0.45 of a foot above standard low water, or 4.45 above that of 1863, December, 1880, the discharge was found to be 47,800 cubic feet per second.

ST. LOUIS BELOW THE MISSOURI RIVER.

Stage.	Discharge.	Stage.	Discharge.
24	96,000	40	414,000
26	126,000	42	480,000
28	156,000	44	546,000
30	186,000	46	636,000
32	222,000	48	740,000
34	264,000	50	864,000
36	306,000	55	1,200,000
38	360,000		

NOTE.—Subtract about 14 feet to give stages on present gauge.

1882, COLUMBUS, KY., 21 MILES BELOW CAIRO.

Stage.	Discharge.	Stage.	Discharge.
67 (Low water.)		86	643,000
68	179,000	88	701,000
70	208,000	90	793,000
72	237,000	92	846,000
74	281,000	94	933,000
76	309,000	96	1,064,000
78	368,000	98	1,136,000
80	426,000	100	1,353,000
82	484,000	102	1,585,000
84	542,000	103 (High water.)	

1884-'85, POINT PLEASANT, MO., 79.5 MILES BELOW CAIRO, 8.7 MILES BELOW NEW MADRID.

[Gauge readings at New Madrid.]

Stage.	Discharge.	Stage.	Discharge.
4.0	165,600	19.9	613,000
8.3	236,800	22.4	712,000
12.8	391,700	24.1	766,700
17.5	502,900	26.5	842,000

1888-'89, NEW MADRID, MO.

6.9	217,000	17.0	444,000
8.9	260,000	19.8	559,000
9.6	275,000	21.0	595,000
10.8	302,000	22.2	646,000
12.1	326,000	24.1	692,000
13.4	355,000	25.6	761,000
15.0	383,000		

1890, BELOW NEW MADRID.

Stage.	Discharge.	Stage.	Discharge.
36.6	1,329,000	....	....

1882, FULTON, TENN., 54.6 MILES ABOVE MEMPHIS.

6.8	169,000	23.7	678,000
9.5	229,000	25.8	764,000
11.6	283,000	27.3	824,000
13.6	335,000	29.5	921,000
15.6	398,000	31.4	1,011,000
17.6	461,000	33.5	1,113,000
19.5	520,000	35.5	1,217,000
21.4	590,000	36.7	1,282,000

1882, MEMPHIS, TENN.

3.5	152,000	21.6	647,000
5.5	193,000	23.6	715,000
7.9	249,000	25.3	776,000
10.0	297,000	27.4	858,000
12.3	360,000	29.4	939,000
15.5	451,000	31.4	1,022,000
17.5	508,000	33.4	1,113,000
19.5	573,000	35.2	1,188,000

1890, MEMPHIS, TENN.

35.5	1,345,000	....	....

1882, HELENA, ARK.

8	160,000	32	692,000
12	216,000	36	818,000
16	300,000	40	972,000
20	384,000	44	1,280,000
24	468,000	48	1,700,000
28	580,000		

1884-'85, HELENA, ARK.

7.2	168,000	26.9	605,400
10.9	226,400	31.9	712,900
14.1	273,600	36.9	826,400
17.6	363,700	38.7	918,500
20.7	428,000	40.5	1,020,700
24.0	513,800		

1888-'89, HELENA, ARK.

Stage.	Discharge.	Stage.	Discharge.
9.0	229,000	27.0	629,500
12.0	289,000	28.7	656,000
15.3	342,000	29.5	685,000
16.4	377,000	30.4	758,000
19.7	450,000	31.2	774,000
24.3	603,000	32.3	800,000
25.6	629,600		

1890, HELENA, ARK.

47.4	1,547,000	....	....

1884-'85, ARKANSAS CITY, ARK.

7.4	221,400	28.7	719,500
8.8	243,000	35.6	892,400
12.8	320,700	37.3	980,000
16.6	365,000	39.0	1,045,000
18.4	414,690	40.3	1,117,000
20.3	457,900	41.7	1,064,000
26.1	637,100		

1887, ARKANSAS CITY, ARK.

46.6	1,479,000	....	....

1889, ARKANSAS CITY, ARK.

20.2	398,000	30.7	635,000
25.5	532,000	32.8	699,000
27.6	587,000	34.9	850,000
29.3	608,000		

1883-'85, 1887-'90, WILSON'S POINT.

[Lake Providence gauge readings.]

30,000 to 50,000 feet is discharged over banks.

34.9	1,091,000	38.5	1,242,000
36.1	1,067,000	40.5	1,289,000

Skipwith break, April 5, 1890, 83,000 cubic feet per second.

1882, HAY'S LANDING, MISS., 36 MILES ABOVE VICKSBURG.

Stage.	Discharge.	Stage.	Discharge.
6	220,000	24	600,000
8	260,000	26	660,000
10	300,000	28	730,000
12	330,000	30	810,000
14	360,000	32	910,000
16	410,000	34	910,000
18	470,000	36	960,000
20	480,000	38	980,000
22	530,000		

1884-'85, WARRENTON, MISS., 7.4 MILES BELOW VICKSBURG.

3.6	209,000	31.0	886,500
7.8	257,200	34.5	987,000
12.7	410,800	39.9	1,150,600
19.6	529,999	41.4	1,060,000

1890. WARRENTON, MISS.

[Vicksburg gauge.]

47.7	1,355,000	....	....

1882. RED RIVER LANDING.

12	275,000	32	740,000
16	365,000	36	905,000
20	415,000	40	1,100,000
24	500,000	44	1,205,000
28	635,000	48	1,550,000

1884-'85. RED RIVER LANDING.

8.0	230,000	37.2	971,000
10.0	263,900	39.1	1,047,000
13.2	332,100	39.7	1,072,000
16.0	350,500	40.5	1,129,800
19.6	448,800	41.7	1,134,000
22.9	521,800	42.0	1,171,000
28.6	624,700	42.1	1,171,300
32.9	826,100		

1890. RED RIVER LANDING.

47.5	1,456,000	....	....

1884–'85. DISCHARGE IN OLD RIVER, NEAR RED RIVER LANDING, LA.

Stage.	Discharge.	Stage.	Discharge.
15.3	5,000	*41.5	16,800
19.7	14,000	*44.6	76,000
21.6	15,500	*48.4	30,000
24.7	40,000	*37.7	99,100
28.3	66,800		

*Discharge depends on whether there is a current and whether water comes from the Mississippi River. These discharges are approximate.

The zero of the gauge at Barbre's Landing on the Atchafalaya is 2.9 feet above sea level.

The zero of the Red River Landing gauge on the Mississippi River is 2.6 feet above the sea level.

The inclination of water surface determines whether the Red River is running into the Mississippi or the Mississippi into the Atchafalaya.

1890. ST. FRANCIS BASIN.

[Discharges through railroad trestles.]

Railroads.	Date.	Velocity per second.	Discharge.
		Feet.	*Cubic feet.*
Kansas City, Springfield and Memphis	Mar. 17–19	1.84	487,500
St. Louis, Iron Mountain and Southern	Mar. 21–22	1.16	578,800
Little Rock and Memphis	Apr. 1–3	2.18	501,200

1890.

Locality.	Stage.	Discharge.
Plum Point Reach	30.3	1,018,000
	30.9	1,077,000
	31.7	1,129,000
	32.1	1,170,000
Natchez	46.7	1,396,000
Simmesport, La	44.5	481,000
Baton Rouge, La	35.3	1,331,000
Donaldsonville, in Bayou La Fourche	23.6	32,000
Carrollton, La	15.9	1,286,000

1885. HEAD OF ATCHAFALAYA RIVER.

[Barbre's Landing gauge readings + 1.1 feet.]

Stage.	Discharge.	Stage.	Discharge.
31.1	106,700	40.7	178,200
33.1	129,200	42.7	203,400
37.6	151,100		

ATCHAFALAYA.

[Barbre's Landing gauge readings.]

Stage.	Discharge.	Stage.	Discharge.
10.1	19,104	39.0	136,000
14.1	28,800	40.0	160,000
17.7	33,900	43.6	180,000
21.2	48,200	48.2	200,000
25.5	71.300	49.5	240,800
29.0	79,500	50.8	280,600
32.4	104,400		

(51 feet is highest gauge reading.)

1884. CARROLLTON, LA., 8½ MILES ABOVE NEW ORLEANS.

0.5	262,900	9.9	803,100
1.0	258,900	11.2	860,000
2.1	320.000	11.9	885,000
3.1	339,000	12.2	927,700
4.1	450.000	13.0	974,800
5.0	486,000	13.2	999,800
9.1	736,400	13.4	1,041,700

1882. CARROLLTON, LA.

[Readings from Engineer gauge, 8½ miles above Signal Service gauge at Canal and Rampart streets.]

2	310,000	10	700,000
3	350,000	11	755,000
4	380,000	12	800,000
5	430,000	13	850,000
6	490,000	14	925,000
7	545,000	15	1,025,000
8	600,000	16	1,100,000
9	650,000		

RED RIVER DISCHARGES AT ALEXANDRIA, 1884.

[Measurements said to be not satisfactory.]

—2.2	2,500	19.1	78,000
—0.4	5,000	22.1	100,800
3.7	15,900	25.4	120,800
6.25	25,200	30.3	137,300
14.2	34,000	34.0	148,100
[16.5	56,000]		

The Red River raft creating lakes, if cleared, it is feared by some, the water which goes to form lakes would then inundate the banks below, etc. Of this Lieut. E. V. Woodruff says:

"This is a favorite theory with some scientific gentlemen, who form theories with great facility at long range. It has been supported by some who ought to know better if they know that a crooked line is longer than a straight line joining two points."

The lakes are reservoirs only up to a certain stage of water. At a higher stage they are an immense cut-off through which the freshets hurry off their volume to the danger of the banks below.

At Camden, on the Ouachita, the amount of water passing at low water is 353 cubic feet per second. At Monroe, on the Ouachita, for a stage 10 to 12 inches above the lowest, the discharge was 800 cubic feet per second. The low-water summer discharge at Camden is about 400 cubic feet per second.

For lowest water at St. Charles, the area of cross section of Missouri River, is 4,705 square feet, with a mean velocity of 4.165 feet per second, and the discharge 19,596 cubic feet per second.

The Kansas River between Wamego and St. Marys showed a discharge of 2,500 cubic feet per second, the stage being 0.4 of a foot above low water. The range between high and low water at Wamego is 15.7 feet; at St. Marys, 15.8; at Topeka, 14.3; the highest water was in 1877. Kansas City is 1.5 miles above the mouth of the river. The discharge of Kaw River, 8,400 feet above its mouth at Kansas City, varies from 1,914 cubic feet per second to 12,345 for a range in stage of 6.7 feet.

The discharge of the Missouri River at Stubbs Ferry for a stage of +0.5 was determined to be 3,770 cubic feet per second. The discharge just below the mouth of Sun River for a stage of 3.05 feet was 19,425 cubic feet per second. The three tributaries of any consequence below Stubbs Ferry are Dearborn River, Deep Creek, and Sun River.

At high-water stage of the Missouri River the discharge of the Dearborn was 622 cubic feet per second; for a stage in the Missouri of 2.75 feet the discharge of Deep Creek was 1,800.5 cubic feet per second, and for a stage of 3.05 feet in the Missouri the discharge of Sun River was 4,269.5.

The volume of water in the Yellowstone is greater than in the Missouri; near Fort Keogh, for a stage of +0.24 foot it is 6,014.85 feet.

SIOUX CITY, IOWA.

Missouri Commission gauge.	Signal service gauge.	Discharge.
667.4	3.6	18,700
670.3	6.5	46,400
673.5	9.7	93,200
675.8	12.0	137,400
677.4	13.6	196,700

OMAHA.

551.3	5.7	14,600
554.0	8.4	46,500
556.0	10.4	113,500
557.7	12.1	135,300

NEBRASKA CITY.

496.6	----------------	21,600
498.6	----------------	41,000
500.9	----------------	72,600
502.8	----------------	123,500
504.9	----------------	201,600
505.2	----------------	239,600

ST. JOSEPH, MO.

Missouri Commission gauge.	Signal service gauge.	Discharge.
386.2	4.8	39,900

ATCHISON, KANS.

356.4	....	22,000
358.4	....	37,200
360.8	....	61,000
363.8	....	100,600
367.9	....	186,000
368.8	....	223,700

KAW RIVER, KANSAS CITY, MO.

Kansas City gauge.	Signal Service gauge.	Discharge.
308.9	....	2,500
312.8	....	5,700
315.4	....	12,300

KANSAS CITY, MO.

308.9	4.9	38,400
310.8	6.8	53,100
313.0	9.0	80,300
315.7	11.7	121,600
318.3	14.3	165,300
320.2	16.2	200,900
321.9	17.9	261,600
325.0	21.0	322,100
327.0	23.0	370,000

ST. CHARLES, MO.

Stage.	Discharge.	Stage.	Discharge.
6.0	25,500	16.0	123,700
8.0	40,200	18.0	152,400
10.0	55,000	20.3	211,500
12.0	67,400	23.3	290,800
13.9	96,200		

The ratio of mean velocity to maximum in a river is about 0.90.

The resistance of a sphere to motion through water as compared with a circle of same diameter is only 0.35; at 2 to 12 feet a second, the ratio is 0.325 and 0.359, mean 0.342.

St. Marie River discharges 89,855 cubic feet per second.

Mean discharge of St. Clair River, 1868, 216,435 cubic feet; in 1869 it was 209,342 cubic feet.

Niagara River, velocity 3.473 feet per second, discharge 304,307 cubic feet, June 10 to July 17, 1868. With velocity of 2.971 feet the discharge was 258,586 cubic feet on July 17 to September 17, 1868. In 1869 the discharge was 214,895 cubic feet per second.

At Ogdensburg the velocity of St. Lawrence River is 1.2884 feet per second, discharge 272,095 cubic feet per second, area of cross section 211,090 square feet.

Point of maximum velocity in a river is at a third to a fifth of the depth.

The mean velocity is 0.87 of the mid-depth velocity.

EQUIVALENT CUBIC FEET PER SECOND AND CUBIC MILES PER DAY.

Cubic feet per second.	Cubic miles per day.*	Cubic feet per second.	Cubic miles per day.*
100,000	0.0587	1,000,000	0.5869
200,000	0.1174	1,100,000	0.6456
300,000	0.1761	1,200,000	0.7043
400,000	0.2348	1,300,000	0.7630
500,000	0.2935	1,400,000	0.8217
600,000	0.3522	1,500,000	0.8804
700,000	0.4109	1,600,000	0.9391
800,000	0.4696	1,700,000	0.9978
900,000	0.5283		

* One cubic mile in a month of thirty days corresponds to a discharge of 56,790 cubic feet per second.

EQUIVALENT FEET PER SECOND AND MILES PER HOUR.

Feet per second.	Miles per hour.	Feet per second.	Miles per hour.
1	0.6818	6	4.0908
2	1.3636	7	4.7726
3	2.0454	8	5.4544
4	2.7272	9	6.1362
5	3.4090	10	6.8180

MISCELLANEOUS INFORMATION ABOUT THE MISSISSIPPI RIVER.

The name given by Père Marquette to the Mississippi was Rivière de la Conception. Michi-sipi is Indian for "great water." The river was called Rio del Espiritu Santo by the Spaniards along the lower course in the year 1520 or thereabout.

Levees were begun at New Orleans in 1720; in 1763 there were 20 miles of levee above and 30 miles below the city. By 1828 the river was leveed up as far as Red River. Above Red River they were disconnected and unfinished as far as Napoleon. In 1844 they were continuous to Napoleon, and there were many isolated levees on the Yazoo front.

The act of September, 1850, granting swamp land to States for drainage and reclamation gave great impetus to levee building, so that by 1858 it reached its greatest extension. In that year they were complete from Commerce to the St. Francis, except about 25 miles, and from St. Francis to Cypress Creek, except about 57 miles around the mouths of White and Arkansas rivers.

Under the Congressional grant of 1850 of swamp lands to States for reclamation a 3-foot levee was built following all the windings of the river along the St Francis front. This was totally destroyed by the floods of 1858 and 1862.

In 1853 Cubit Gap opening occurred; there was a 3-foot slope in 1,000 feet. Shreve's cut-off in 1831 severed from the Mississippi the bend in which the Red River discharged and from which the Atchafalaya was supplied. Prior to this the navigation was impaired (?) by back water from the Mississippi, which occasionally extended to Alexandria and to Monroe, on the Washita.

"The average mean width of river from 8 miles below Cairo to Red River Landing, 754 miles at bank-full stage, is 4,642.6 feet; the depth is 43.84 feet; the area of cross section of river is 203,532 square feet; the reservoir capacity is 5.519 cubic miles.

"The average mean width of river from Red River Landing to Head of Passes, 296 miles at bank-full stage, is 2784.8 feet; the depth is 66.92 feet; the area of cross section of river is 186,359 square feet; the reservoir capacity is 1.978 cubic miles. Water stages for the above are: Memphis, 31.1 feet; Helena, 43.6 feet; Arkansas City, 41.8 feet; Vicksburg, 44.1; Red River Landing, 46.3; Baton Rouge, 33.0; Carrollton, 9.2." (Extract from letter of April 10, 1889, Engineer Commission.)

Bayou Plaquemine was closed in the autumn of 1865, increasing the flood discharge of the Mississippi below its mouth by about 35,000 cubic feet per second.

Abbot: Flood of 1858, to restrain it in channel, would require levees 6.5 feet higher at Memphis, 8 feet higher at Osceola.

The rises and falls are extremely uniform in the Upper Mississippi River all along, being 16 to 22 feet, slightly greater in the narrow parts; it increases towards the junction with the Missouri and Illinois. The low-water velocity is 1 mile per hour; the high, 3 miles. The high-water flow of the Upper Mississippi River is 10 to 15 times that of low water. From Donaldsonville to Head of Passes the river width changed from 2,244 feet in 1851 to 2,310 in 1885, an increase of 66 feet.

There are railroad bridges across the Mississippi at Winona, La Crosse, Prairie du Chien, Dubuque, Clinton, Rock Island, Burlington, Keokuk, Quincy, Hannibal, and Louisiana, Mo.

Humphreys and Abbot cross section, Cairo to ArkansasRiver, high water, 191,000 square feet; Arkansas River to Red River, 199,000. At low water, 45,000 and 54,000. The width, Cairo to Arkansas, is 4,470 feet, and at low water, 3,400. Width, Arkansas to Red River, 4,080; at low water, 3,060.

At Columbus, Ky., June 17, 1858, the highest mean velocity of a cross section was 11.1 feet per second.

The radius of concave bends is rarely less than a mile, and that of a long bend is usually 2 miles, sometimes rising to 3 miles for bends of 180°.

The discharge in 1862 into alluvial region was less than in 1858, probably short of it by 50,000 cubic feet per second.

(The Mississippi just above Cairo, lowest water discharge, 39,192 cubic feet per second.) (?)

The volume of the Atchafalaya is one-twelfth of that of the Mississippi where they separate. The slope of the former is 0.5 foot per mile, of the Mississippi is 0.167.

The volume of South Pass is one-fourth that of Southwest Pass.

The influence of the Gulf on the river at high stages is hardly felt above the mouth of the Red River. The Red River and the Raccourci cut-off in 1851 lowered the river 4.6 feet; it was not felt at all 100 miles above.

SPRING TIDES.

Locality.	Flood stages.	Low stages.
	Feet.	*Feet.*
At the Gulf	1.7	1.7
At the forts, 36 miles above	0.6	1.4
At Carrollton, 120 miles above	1.3	1.1
At Donaldsonville, 192 miles above	.0.0	0.9
At Baton Rouge, 244 miles above		0.4
At Red River, 315 miles above		0.0

Chutes are high-water channels across low elongated points.

The water level below a cut-off is raised by an amount equal to half the fall in a straight portion equal in length to the shortening of the channel, and is lowered just above it by an equal amount plus the fall required to overcome the resistance due to the curvature of the bend.

On the Mississippi, banks are deteriorated where sandy by infiltration of water at high stages, which in running out at low stages carries the sand with it.

MISSISSIPPI RIVER FLOOD OF 1867.

The southern part of the Ohio Valley had an unusual downfall of snow and rain in the winter of 1866-'67. A sudden thaw gave moderate floods in the Allegheny and Monongahela rivers and a great flood in the Wabash, second only to that of 1858. At Louisville, February 22, within 8 feet of high water of 1832. At Caseyville, below the mouth of the Wabash, it was 0.5 of a foot, on March 1, above high water of 1832, the greatest on record. At St. Louis the river began rising February 13; on the 21st it was 24.4 feet on gauge.

In March there was a widespread series of rain storms from the headwaters of the Washita and White rivers to the northeast as far as West Virginia, and a perfect deluge at the head of the Tennessee River, in the mountains. At Chattanooga, on March 11, 1867, the stage was 53 feet. At Cincinnati there was a long-continued high stage beyond precedent (at that time).

For a given stage there is more water passing when a river is rising than when it is falling.

There is more water passing for a given stage in a long and slow rise than a short and rapid one; not always, however, as it depends on stages above and below. The maximum discharge occurs for a stage a few inches below highest stage.

When a freshet culminates and the water comes to a stand or begins to fall, and a second rise occurs, it will cause the surface to rise considerably higher than would have been the case had the same volume passed without a previous diminution of supply.

There was no overflow into the St. Francis between Cape Girardeau and Cairo in 1867. In 1858, at date of maximum discharge at Cairo, 35,000 cubic feet per second was passed through Cape Girardeau Inlet and 20,000 cubic feet over the banks between Commerce Bluffs and Cairo, giving a total maximum discharge into the alluvial region of 1,475,000 cubic feet per second, or 55,000 more than in 1867.

The simultaneous breaking of several immense levees below Helena lowered the water anomalously 3.2 feet (1858).

The St. Francis in 1858 was contributing 30,000 cubic feet of rain water to the Mississippi at the time when the great wave, if restrained to the channel, would have passed.

The volume of water absorbed in 1867 in filling bed of river between Cairo and Helena was 186,000 cubic feet per second.

At the date of the highest water at Napoleon, April 30, the Arkansas was checked for a distance of 53 miles above its mouth by backwater from the Mississippi.

There was a moderate freshet in the Arkansas, and especially the White River, in March, 1867. In 1858 the maximum flood wave would have received 60,000 cubic feet from these two tributaries if confined to channel, making its volume 197,000 cubic feet larger than the actual maximum discharge.

In 1858 the Yazoo at Vicksburg would have contributed 30,000 cubic feet per second.

The total discharge at New Orleans November 1, 1864, to October 31, 1865, was 20,788,000,000,000 cubic feet, much less than in great floods, which is usually 27,000,000,000,000. The 1865 flood was much less than that of 1867. In 1862 there was a great flood, but imperfect records; it compared with the traditional overflows of 1815 and 1828.

May 2, 1862, there was extreme high water at Cairo; a crest stage at Cincinnati April 26 was 52.2 feet. There was a high stage in the Cumberland in the spring and a destructive overflow in the Wabash in February; April 26, at St. Louis it was 31.3 feet.

The St. Francis on the west is bounded by Crowley Ridge, an elliptical section 200 miles long by 35 miles wide, extending from mouth of river to Cape Girardeau, 6,900 square miles; 600 square miles is entirely above overflow; the rest is submerged in great flood years to a depth of 3 feet; the slope north to south is 8 inches to the mile and from east to west is 6 inches; it is crossed by low ridges extending westward.

The St. Francis bottom differs from the Yazoo; in the latter water once leaving the river commonly returns into it through the Yazoo River near its mouth. The water from St. Francis bottoms returns to the Mississippi through the following bayous: James, near Island 8; St John, at New Meadow; Walker's, near Island 15; Mill, opposite Island 30; Wappenoky, near Island 40, and a bayou near Island 46. There is an immense discharge in great floods from the St. Francis over the banks on each side of its mouth, extending from Helena to Walnut Bend.

Nearly all the overflow above New Madrid, in an area of 1,500 square miles, is returned to the river by the high ridge called Big Prairie, which, extending north from that town, is followed by the river. From mouth of St. Francis to New Madrid is 170 miles.

The combined rain and crevasse discharge from the Yazoo, which raised the Mississippi at Vicksburg 3 feet during the last three weeks of April, must at its maximum have equaled 110,000 cubic feet per second; 20,000 from crevasses, the rest drainage. (Speculative.)

In 1858 the Yazoo contribution at the top of the Mississippi flood measured was 129,000 cubic feet per second, of which only 30,000 was rain water. The maximum rain-water discharge of the Yazoo in its great April rise of 1858 was 70,000 cubic feet per second.

Great floods in Red River in 1849, 1851, and 1858. At Alexandria it rose steadily to 23.4 feet between February 1 and April 4, continuing until May 12, the highest 1.6 below highest of 1866.

The greatest flood that ever occurred in the Washita was in 1874.

In 1851 the united maximum discharges of these rivers, Red, Washita, and tributaries, measured 220,000 cubic feet per second, and in 1858, 180,000; no crevasse water included in either case.

The maximum volume discharged into the head of the alluvial region in the flood of 1874 was about 1,225,000 cubic feet per second.

In 1874 the White and Arkansas, it is estimated, at the highest, discharged 130,000 cubic feet per second.

The gauge at Vicksburg in 1874 showed that the actual volume that reached the mouth of the Yazoo by the bed of the Mississippi River was at no time greater than 1,000,000 cubic feet per second. The crevasse discharge between Vicksburg and Helena was 290,000 cubic feet per second, the greater part in Carroll Parish, La.

MISSISSIPPI RIVER DISCHARGE, 1882.

Place.	Maximum cubic feet per second.	Amount outside channel.
Columbus	1,600,000	200,000
Fulton	1,200,000	600,000
Helena	1,540,000	360,000
Hay's Landing	1,060,000	940,000
Red River Landing	1,600,000	600,000

The estimated increased heights of levees in 1882 to restrain water was 10 feet at Hay's Landing, 4 at Helena, 3 at Columbus, and 10 feet at Fulton, Tenn. (Gen. Comstock). Mississippi River discharge at latitude of Helena, maximum 1890 flood, 1,617,000 cubic feet per second; 231,000 less than in 1882. At Arkansas City, 1,724,000 on April 13, 1890; in 1882 about 2,000,000. At mouth of Red River, 2,031,587 May 7, 1890; in 1882, 2,200,000.

"In the flood of 1884, for 52 feet stage at Cairo, 200 square miles in southern Illinois was covered: north of Cairo to Mound Junction, 9 miles, and east and west to highlands in Missouri and Kentucky, 22 miles. From Cairo for 30 miles south the average width of overflow was 20 miles." (Signal Service observer, Cairo.)

BANK-FULL STAGE OF RIVER ON GAUGE, 1890.

Locality.	Stage.	Locality.	Stage.
Cairo	39.3	White River	44.4
Columbus (21 miles below Cairo)	94.0	Arkansas City	41.8
New Madrid	33.1	Vicksburg	44.1
Memphis	31.1	Baton Rouge	33.0
Helena	43.6	Carrollton	8.9

HIGH WATER AT ALEXANDRIA.

	Feet.
1849	35.4
1866	36.5
1872	33.2

HIGH WATER, BATON ROUGE.

Year.	Stage.	Year.	Stage.
1828	34.7	1858	34.5
1844	33.9	1859	35.0
1849	34.9	1862	36.1
1850	34.5	1874	36.2
1851	34.5		

HIGH WATER, HELENA, ARK.

1828	43.1	1858	44.6
1844	42.2	1862	46.4
1849	42.8	1867	45.8
1850	42.8	1874	45.8

HIGH WATER, JACKSONPORT, ARK.

	Feet.
1867	32.8
1874	31.1
1876	31.7

HIGH WATER, LITTLE ROCK, ARK.

1857	31.0
1874	23.0

HIGH WATER, MEMPHIS, TENN.

Date.	Stage.	Date.	Stage.
1828	32.9	1852	33.0
1844	33.2	1858	34.2
1849	30.9	1859	34.1
1850	33.6	1867	34.8
1851	33.2	1874	34.0

HIGH WATER, NASHVILLE, TENN.

1847	54.7

NATCHEZ, MISS.—See Report of Chief of Engineers, 1876, Part 1, p. 613, for long record of high waters since 1802.

HIGH WATER, VICKSBURG, MISS.

[Old gauge.]

Date.	Stage.	Date.	Stage.
1828	47.7	1850	48.4
1844	47.5	1858	48.3
1849	47.7	1859	49.6

[New gauge.]

1862	51.1	1867	49.0

1872-1889.

Locality.	Mean high water.	Lowest water.	Highest water.	Range, highest and mean high.	Average number days above mean high.
Cairo	44.34	−1.00	52.17	7.83	14
Fulton	33.04	+1.60	36.69	3.65	
Memphis	32.52	−0.95	35.30	2.78	21
Helena	42.81	−0.20	48.10	5.29	18
White River	45.53		48.40	3.07	17
Arkansas City	44.09	+0.30	47.00	2.91	
Greenville	39.48	+1.85	(41.68)?	2.20	
Lake Providence	36.55	−3.85	38.40	1.85	24
Vicksburg	42.90	−3.92	49.00	6.10	25
Natchez	42.20		47.75	5.55	29
Red River Landing	41.92		48.50	6.58	25
Baton Rouge	31.73		36.20	4.47	26
Carrollton	13.28		15.70	2.42	26

MISSISSIPPI RIVER.

The distance along the Mississippi River from Lake Itasca to the mouth of the Missouri River is 1,324 miles. The distance of the most important tributaries from the mouth of the Missouri River and the lengths of some of them are as follows:

Tributaries.	Distance from Missouri.	Length.	Tributaries.	Distance from Missouri.	Length.
	Miles.	*Miles.*		*Miles.*	*Miles.*
Turtle River	1,180	40	Elk or St. Francis	705	100
Leech Lake River	1,109	50	Crow River	699	
Wash-kudens River	1,055		Rum River	690	150
Wild Swan River	998		Rice River	683	
Sandylake River	960		St. Peters River	663	
Willow River	930		St. Croix River	631	168
Pine River	863	140	Vermilion River	630	
Crow Wing River	815		Cannon River	611	82
Nokay River	806		Chippewa River	581	165
Belle Prairie Creek	796		Embarras River	562	
Elk Creek	782		White River	560	
Pike Creek	787		Black and La Crosse	516	128
Two Rivers	777		Root River	511	83
Swan River	786		Upper Iowa River	489	
Spunk River	773		Wisconsin River	448	338
Platte River	771		Turkey River	425	
Little Rock Creek	760		Wabsipinicon River	320	205
Watab and Winnebago rivers	757		Rock River	291	245
Lower Watab	754		Cedar River	245	255
Sauk River	752		Skunk River	205	
Nechoado River	744		Des Moines	165	402
Clear Water River	736		Illinois River	24	397

AREAS OF BASINS DRAINED BY THE TRIBUTARIES OF THE MISSISSIPPI RIVER FROM THE SOURCE TO THE OHIO RIVER.

[Authority, U. S. Engineer's Report 1872, Part 2, p. 924.]

	Drained.	Total drained.	Distance apart.
	Sq. miles.	*Sq. miles.*	*Miles.*
Upper Mississippi, above the Minnesota		19,903	
Minnesota River	310	310	
Whetstone, or Izuza River	110	420	30
Yellow Banks River	340	760	6
Pomme de Terre River	960	1,720	13
Lac Qui Parle River	830	2,550	15
Chippewa River	1,970	4,520	10
Yellow Medicine River	650	5,170	20
Chetomba, or Hemp Creek	470	5,640	1
Redwood River	770	6,410	20
Beaver Creek	240	6,650	2
Big Cottonwood River	980	7,630	37
Little Cottonwood River	245	7,875	4
Blue Earth River	3,350	11,225	16
Cheney Creek	57	11,282	15
Little Le Sueur River	114	11,486	7
Rush River	102	11,528	2
High Island Creek	75	11,603	6
Sand Creek	234	11,837	18
Carver Creek	100	11,937	1
Credit River	140	12,077	15
Nine Mile Creek	42	12,119	2
Mississippi River	21,600	33,719	9
St. Croix River and Lake	7,568	41,287	30
Vermilion River	237	41,524	3
Trimble River	95	41,619	9
Cannon River	1,639	43,258	5
Isabella River	73	43,331	5
Rush River	183	43,514	4
Chippewa River	9,602	53,116	18
Beef River	452	53,568	9
Zumtro River	1,366	54,939	9
Whitewater River	382	55,316	1
Eagle River	158	55,474	9
Rolling Stone Creek	136	55,610	6
Trempeleau River	700	56,310	10
Black River	2,880	59,190	18
La Crop River	463	59,653	
Root River	1,685	61,338	4
Raccoon Creek	139	61,477	7
Crooked Creek	70	61,547	3
Bad Axe River	180	61,727	7
Upper Iowa River	939	62,666	3
Paint Creek	70	62,736	25
Yellow River	279	63,015	4
Wisconsin River	11,850	74,865	7
Turkey River	1,679	76,544	21
Grant River	289	76,833	13
Platte River	306	77,139	6
Little Makoqueta River	150	77,289	3
Catfish Creek	75	77,364	7
Big Menominee Creek	32	77,369	4
Sinsinana Creek	50	77,446	4
Tete de Mort Creek	45	77,491	1
Fever River	185	77,676	3
Mill Creek	35	77,711	7
Makoqueta River	1,836	79,574	7
Apple River	245	79,819	4
Rush Creek	85	79,904	2

AREAS OF BASINS DRAINED BY THE TRIBUTARIES OF THE MISSISSIPPI RIVER FROM THE SOURCE TO THE OHIO RIVER—Continued.

[Authority, U. S. Engineer's Report 1872, Part 2, p. 924.]

	Drained.	Total drained.	Distance apart.
	Sq. miles.	*Sq. miles.*	*Miles.*
Plumb River	280	80, 184	6
Wabsipinicon River	2, 490	82, 674	28
Rock River	10, 690	93, 364	25
Copperas Creek	25	93, 389	26
Iowa River	12, 250	105, 639	15
Edwards River	43	105, 682	2
Pope Creek	135	105, 817	4
Henderson River	625	106, 442	18
Flint Creek	165	106, 607	4
Ellison Creek	104	106, 711	3
Honey Creek	65	106, 776	5
Skunk River	4, 322	111, 098	1
Sugar River	150	111, 248	18
Des Moines River	14, 955	126, 203	32
Fox River	479	126, 682	4
Bear Creek	418	127, 100	15
Wyaconda Creek	480	127, 580	5
Fabins River	1, 590	129, 170	13
North River	465	129, 635	2
Mill Creek	96	129, 731	3
McDonald Creek	140	129, 871	13
Salt River	2, 741	132, 612	18
Noix Creek	52	132, 664	3
Buffalo Creek	40	132, 704	1
Bobb Creek	90	132, 794	13
Guinn Creek	25	132, 819	2
Bryant Creek	75	132, 894	19
Cuivre Creek	1, 180	134, 074	9
Pirogue Creek	90	134, 164	3
Dardenne Creek	110	134, 274	6
Illinois River	27, 465	161, 739	8
Big Piasa Creek	100	161, 839	10
Missouri River	518, 000	679, 839	10
Wood River	145	679, 984	
Cahokia Creek	400	680, 384	17
Meramec River	3, 715	684, 099	18
Eagle Creek	70	684, 169	7
Platin Creek	110	684, 279	5
Lisle de Bois Creek	50	684, 329	9
Establishment River	110	684, 439	6
Riviere aux Vases	100	684, 539	4
Saline River	240	684, 779	12
Kaskaskia River	5, 660	690, 439	7
St. Marys River	215	690, 654	4
Brazos Creek	40	690, 694	24
Big Muddy River	2, 245	692, 939	6
Apple Creek	200	693, 139	1
Clear Creek	135	693, 274	18
Ohio River			42

NOTE.—The report of 1880 makes a difference of 1,697 square miles in the area of the Upper Mississippi above the Minnesota.

"The average rainfall for sixteen years equals 25 inches a year in the Upper Mississippi Valley." (Extract from U. S. Engineer's Report, 1875, p. 435.)

Cap Lake is 135 miles below Lake Itasca and 1,318 feet above the sea. Area, 31.6 square miles. From Cass Lake to Winnibigoshish about 20 miles, fall 10 feet, surface area 78½ square miles. Little Winnibigoshish, 2 miles below, area about 1.13 square miles, distance to Leech River 25 miles, fall 11.1 feet. From the junction to Pokegama Falls 45 miles, fall 13⅞ feet. Surface area of Leech Lake, 195 square miles. Fall at Pokegama Falls, 14 feet in 880 feet; area of Pokegama Lake, 15⅝ square miles. Vermilion River is 25 miles above Pokegama Falls.

Above the Pokegama Falls the whole country is, in a certain sense, a reservoir. There are no freshets.

The drainage basin above St. Paul is 33,719 square miles. Below, to the Illinois River, 25 miles above the mouth of the Missouri, there is 52,399 square miles of drainage area on the right bank, and 48,156 on the left bank.

Prescott is at the junction of the St. Croix River with the Mississippi; range of water surface, 22 feet.

The high-water width of river at St. Louis is 6 miles; low water, 1,500 feet.

The Illinois River is formed by the junction of the Des Plaines and Kankakee rivers. It drains 27,465 square miles.

A short distance below Cape Girardeau the bluffs along the river recede, and a depression about 4 miles in length allows the water in floods to escape into the swamps.

The valley above Grand Tower is from 3 to 8 miles wide and mostly subject to flood. The area drained by the St. Francis is about 9,700 square miles.

The Yazoo Basin is 13,850 square miles. There is a ridge separating the Yazoo and Tallahatchee from the Sunflower River, supposed to be a continuation of Crowley's Ridge in the St. Francis Basin. The area of this belt of high land is 310 square miles.

The Coldwater, Tallahatchee, and Yazoo are continuations of the same river. The Tallahatchee joins with the Yallabusha, about 5 miles above Greenwood, to form the Yazoo, which enters the Mississippi about 9 miles above Vicksburg. From Yazoo City to mouth of river is 100 miles.

Along the St. Francis there are many bayous, from 6 to 12 feet below the top of the bank, that draw off water from the Mississippi River. It is very different in the Yazoo Basin. The flood waters enter the bottom over the bank in but two places, at and above Star Landing for a distance of 9,300 feet, and opposite Island 64 for a distance of 3,300 feet.

RIVERS ABOVE PITTSBURG.

Buffalo Creek, west bank of Allegheny River, comes into the Allegheny River just below Freeport and drains an area of 150 square miles.

The gauging of French Creek in 1839 by James Warrall, civil engineer, gave 370 cubic feet per second at low water, but not the lowest. French Creek empties into the Allegheny River 130 miles above Pittsburg level, 261 above the river at Pittsburg.

Oil Creek above French Creek drains an area of 270 square miles.

Broken Straw Creek drains 240 square miles.

Connewango Creek, entering the Allegheny at Warren, drains 960 square miles, including Chautauqua Lake.

EAST BANK OF ALLEGHENY RIVER.

Just above Freeport the Kiskiminitas, over 100 miles long, enters. At Johnstown is the junction of the Connemaugh River and Stoney Creek. The Conemaugh above Johnstown drains an area of 200 square miles and Stoney Creek an area of 450.

Below Blairsville the principal tributary of the Kiskiminitas is the Loyalhanna, draining about 300 square miles.

Black Lick Creek, entering the Kiskiminitas below Blairsville, drains somewhat less than 300 square miles.

The next above is Crooked Creek, draining an area of 280 square miles, entering a few miles below Kittanning. It has a rapid fall and the valley is narrow.

The next is Cowanshanoc Creek, entering a short distance above Kittanning. It does not drain over 75 square miles.

The next above is Mahoning, which drains 400 square miles.

The next is Red Bank, draining 650 square miles.

The next is Clarion River, which drains about 1,400 square miles.

The next is the Tionesta, entering about 30 miles above Franklin. With its Raccoon Fork it drains about 500 square miles.

The next is Kenjua Creek, draining 200 square miles.

The last tributary of the Allegheny on the east side is Potato Creek, which drains about 150 square miles.

The Allegheny in low water has twelve times the flow of the Monongahela River. The Monongahela River is formed a short distance above Fairmont by the junction of Tygart Valley River and the West Fork of the Monongahela River. Tygart Valley River drains an area of 1,390 square miles. The principal tributaries of the Monongahela are the Youghiogheny and the Cheat.

DISTANCES FROM PITTSBURG.

To—	Miles.	To—	Miles.
Lock No. 4	41.0	Morgantown Bridge	102.2
Freeport	29.6	Fairmont Bridge	128.0
Brownsville	57.0	Grafton	150.0
Greensboro	85.5	Oil City	130.0
Cheat River	90.5	Warren	187.7

MISCELLANEOUS INFORMATION CONCERNING THE OHIO RIVER.

The Ohio River drains an area of 220,000 square miles (201,720 by census bulletin). The Allegheny is navigable to Olean, 239 miles above Pittsburg, and the Monongahela 115 miles.

An old saying about the Ohio River, "Dry half of the year; frozen the other half," is not justified.

With a 40-foot stage at Cincinnati there is 12 to 14 feet on the falls at Louisville. The river usually curves, but at Sardis there is a straight reach of 16 miles.

There are 54 islands on the Upper Ohio and 31 on the lower, each several miles long and half a mile wide. The Ohio usually freezes about Christmas. In 1855 it was frozen at Louisville sixty-five days, the longest time ever known.

At high water in the Ohio River the backwater up the Mississippi River extends to Commerce, 37.5 miles above the mouth of the Ohio.

TRIBUTARIES OF THE OHIO RIVER.

Name.	Side.	Distance from Pittsburg.	Remarks.
		Miles.	
Little Beaver	Right.	40	Glasgow at mouth.
Beaver River	do	26	Continues to Lake Erie by canal, Beaver and Rochester at mouth.
Big Muskingum	do	171	Marietta at mouth.
Little Kanawha	Left	183.5	Parkersburg at mouth.
Big Hockhocking	Right.	197.5	Hocking Port at mouth.
Shade River	do	208.75	
Big Kanawha	Left	263	Point Pleasant at mouth.
Raccoon Creek	Right.	274.5	
Guyandotte	Left		Guyandotte at mouth.
Big Sandy	do	316	Catlettsburg at mouth.
Big Scioto	Right.	357	Portsmouth at mouth.
Little Miami	do	463	
Licking	do	470	
Big Miami	do	490	Dayton 80 miles up.
Kentucky	Left	552	Carrollton, Ky., at mouth.
Salt River	do	638	West Point at mouth.
Green River	do	809	
Wabash	Right.	870	Lafayette 400 miles up.
Saline River	do	893	Logansport 465 miles up.
Tradewater River	Left	899	

TRIBUTARIES OF THE OHIO RIVER—Continued.

Name.	Side.	Distance from Pittsburg.	Remarks.
		Miles.	
Cumberland River	do	952.5	Smithland at the mouth, Nashville 200 miles up: navigable 500 miles further up.
Tennessee River	do	965.5	Paducah at mouth; navigable 700 miles. Four hundred miles from mouth are the Muscle Shoals extending 18 miles. At extreme high-water 5 feet on shoals, 28 miles below Decatur.

The Great Kanawha is formed by the union of the New River, the Greenbrier, and the Gauley. Kanawha Falls is 94 miles above the mouth.

The Elk River is the next important tributary, draining 1,600 square miles.

(On the 1st of August, 1882, the gauge readings at Charleston were complete for ten years.)

The Little Kanawha with its tributaries drains an area of 3,200 square miles. From Parkersburg to the Forks is 152 miles. Backwater from the Ohio has been known to extend to Burning Springs, 38 miles above Parkersburg.

The Muskingum drains an area of 12,000 square miles

At the Louisville Falls the declivity in the Ohio River is 25.7 feet in 4 miles. The entire length of the Ohio is 967 miles.

WIDTHS.

Place.	Distance from Pittsburg.	Width.
	Miles.	*Feet.*
Allegheny City	2	1,100
Two miles above Wheeling	88	900
Parkersburg	183	1,200
Little Guyandotte	285	1,200
Portsmouth	353	1,050
Cincinnati	467	1,100
Six miles above Louisville	592	2,500
New Albany	603	1,500
Flint Island	682	2,700
Evansville	782	3,000
Five miles below Shawneetown	852	2,300
Paducah	920	3,500
Mound City	959	4,000

FLOOD OF 1832 HEIGHTS ABOVE LOW WATER.

Locality.	Height.	Locality.	Height.
	Feet.		*Feet.*
Pittsburg	35.6	Gallipolis	54
Steubenville	45.0	Cincinnati	62.5
Wheeling	43.5	Louisville	44.5
Bellaire	50.0	New Albany	63.6
Parkersburg	50.0	Paducah (1867)	52.25
Letart Falls	58.0	Cairo (1867)	52.54

Wabash River, 1867, only one important rise. At Eugene, Ind., 350 miles above the mouth, the high water of 1858 was 28 feet above low water. It was 1 foot above that of 1828 and 1844, 4 feet above 1851, and 2 feet above that of 1867. During the thirty-four years, 1833 to 1866, six crops have been lost by overflows. In 1862 the high water occurred in February and was very destructive. At Terre Haute the high water of 1867 was 1.3 feet below the high water of 1858, the highest on record, culminating on February 21 with the river 25.3 feet above low water. The rise began February 9. At Vincennes the river was out of its banks from February 19 to March 2, being highest on February 22 and 23, when it was 0.5 of a foot higher than ever before, 25 feet above low water.

Carthage, Tenn., 1867 high water was 7 feet below 1826, 4 feet below 1847, 1 foot below 1862, and was 40 feet above low water. The rise began February 25, culminated March 9 to 12, subsided 8 feet and again swelled.

At Nashville the stage was 0.8 foot below high water of 1847. On Harpeth Shoals, 30 miles below, the flood stood 64 feet. At Eddyville 1.2 feet above high water of 1847.

Tennessee River, the flood exceeded all for ninety years previous. Great rain in the mountains, continuous at Kingsport on the Holston from February 28 to March 7. At noon, March 7, the stage of water was 30 feet, 4 feet higher than ever before. At Strawberry Plains the freshet rose 52 feet above low water and 11 feet above any other flood. At Knoxville the river rose 12 feet above high-water mark of 1847 and was over 50 feet deep. Near Harrison the rise was 15 feet above any known water mark.

At Chattanooga, March 11, 1867, the stage was 53 feet; it began rising March 4 and was 15.5 feet above high water of 1847. At Bridgeport, Ala., late on March 12 it was 11.5 feet above all former marks; at Bellefonte, Ala., March 13, it was 9.1 feet above 1847; at Decatur, March 16, 6 or 7 feet above any former mark; at Florence March 15, 6 feet above all other floods; at Eastport, 7 feet above any known flood; at Johnsonville 3.8 feet above any known flood and 44.8 feet above low water.

Destruction of life and property was beyond parallel in Tennessee Valley.

The mouth of the Wabash River is 129 miles above the mouth of the Ohio River. Mount Carmel is 90 miles above the mouth of the Wabash. Vincennes is 148 miles above the mouth. The principal tributaries are the White and Eel rivers. The White River enters 2 miles above Mount Carmel. The Eel River enters at Logansport, Ind.

The Big Sandy and its branches drain an area of 4,600 square miles.

Guyandotte River rises in the Cumberland Mountains, and comes into the Ohio about 12 miles above the mouth of the Big Sandy and 164 miles above Cincinnati. The drainage basin is heavily wooded. A notable feature of the river is the absence of all tributaries, except in a rainy season, from the mouth of Mud River to a point 40 miles above Logan Court-House, 81 miles above the mouth of the stream.

The Clinch River drains 1,336 square miles. From mouth of Hiawassee River to Charleston, Tenn., is 47 miles. Elk River enters the Tennessee at Muscle Shoals.

The drainage area of the Cumberland River, above the Great Falls, is about 2,500 square miles.

The principal tributaries of the Cumberland are the Red and Obey rivers, and Caney and South Forks. The Red River is the principal tributary below Nashville. South Fork enters the Cumberland at Burnside, 209 miles above Carthage. It is formed by the confluence of New River and Clear Fork, about 52 miles above Burnside. The highest water is 74.5 feet.

The Tradewater River, coming into the Ohio just below Caseyville, has a drainage basin 60 miles in length by 20 in breadth, with an area of 827 square miles.

ALABAMA RIVER.

Locality.	Distance from Mobile.	Low water above sea level.	High water 1874.
Wetumpka	367	117	58.3
South & North Alabama R. R. bridge	344	105	53.5
Montgomery	338	103.4	53.2
Western R. R. bridge	264.5		55.0
Selma	256.5		53.0
Claiborne	119.5		42.0
Gainstown	95.5		28.0
Davis Lodge	69.5		23.0
Cut-Off	60.2	12.0	21.9
Mouth of Alabama River	44.5		20.0
Seymores Bluff	31.0		16.25
Mobile			1.00

Elevation of low water a little below Rome, Ga., on the Coosa River above mean low tide in Mobile Bay is 590.80 feet; low water at the mouth of Wills Creek is 528.30 feet; distance apart 120 miles. The extreme difference between high and low water at Rome is 29 feet, at Gadsden 28.

At Montgomery, for a stage of 1 foot above ordinary low water, the discharge of the Alabama River is 3,711 cubic feet per second with a mean velocity of 2 feet per second below Newport Bar; and at Woods Upper Landing, 20 miles lower down 3,734 cubic feet with a velocity of 1.57 feet per second.

The discharge of the Black Warrior at Tuscaloosa Landing for gauge reading 108 feet is 3,422 cubic feet per second, for 145 feet it is 84,266 feet per second. Above 145 feet banks overflowed.

The Etowah is 110 miles in length above Rome, Ga., 250 feet wide, has 6 bridges and 2 milldams. From Rome to the mouth of Little River, a distance of 63 miles, the fall is 232 feet.

At Guntersville the distance between the Tennessee and Coosa rivers at Gadsden is 45 miles.

Between Asheville, N. C., on the French Broad River, and the Catawba, which flows to the Atlantic Ocean, the distance is 40 miles.

The Missouri River is formed by the Jefferson, Madison, and Gallatin at what is called Three Forks. Two hundred miles below, the Great Falls commence separating the river into two natural divisions, Missouri River above the falls and Missouri River proper. The latter portion is subdivided into the Rocky River, confined between Benton and Carroll, and the Sandy River from Carroll to the mouth. The drainage area of the Missouri above Fort Benton is 24,103 square miles. The channel length is something over 3,000 miles. The range of water stages at Fort Benton is about 6 feet.

MISSOURI RIVER.

Bismarck is opposite the mouth of the Heart River. The low-water discharge of the Gasconade is 450 cubic feet per second.

DISTANCES UPON THE MISSOURI RIVER.

[Humphreys & Abbot, page 51.]

Locality.	Distance above mouth of Missouri.	Locality.	Distance above mouth of Missouri.
	Miles.		*Miles.*
Mouth of Osage River	132	Mouth of Big Sheyenne River	1,300
Mouth of Kansas River	382	Mouth of Moreau River	1,367
Northern boundary of Kansas	530	Mouth of Grand River	1,391
Northern boundary of Missouri	617	Mouth of Cannon Ball River	1,479
Mouth of Platte River	640	Mouth of Heart River	1,522
Mouth of Big Sioux River	842	Fort Clark	1,584
Mouth of James River	976	Mouth of Knife River	1,593
Mouth of Niobrara River	1,026	Mouth of Little Missouri River	1,673
Mouth of White Earth River	1,136	Mouth of Yellowstone River	1,888
Fort Pierre	1,246	Fort Union	1,894

The drainage area of the Yellowstone is approximately 78,750 square miles. Fort Buford is 3 miles below the mouth of the Yellowstone and 299 miles above Bismarck. Fort Benton is 816 miles above Bismarck. The drainage area of the Osage River is about 13,600 square miles.

Brunswick is near the mouth of the Grand River, 257 miles above the mouth of the Missouri and 60 miles above Boonville.

Lexington is 63 miles above Brunswick.

Kansas City, at the mouth of the Kansas River, is 60 miles above Lexington and 386 miles above the mouth of the Missouri River.

The Kansas, one of the largest tributaries of the Missouri, is formed by the junction of the Smoky Hill and the Republican rivers, 190 miles from its mouth.

Leavenworth is 33 miles above Kansas City, and is opposite the mouth of the Little Platte River.

St. Joseph is 61 miles above Leavenworth.

Plattsmouth is 1.5 miles below the mouth of the Platte River, and 161 miles above Leavenworth.

Omaha is 27 miles above Plattsmouth.

Yankton is just below the Dakota River, and 896 miles from the mouth of the Missouri River.

The tributaries entering the Missouri River from the south and west are the Gasconade, Osage, Kansas, Platte, Niobrara, White, Wakpo-Washte, Grand, Little Missouri, Yellowstone, and Muscle Shell rivers. From the north and east the Grand, Little Sioux, Big Sioux, Dakota, Milk, Marais, Medicine or Sun rivers.

Hermann is 101 miles above the mouth of the Missouri River, and 6 miles below the mouth of the Gasconade.

Jefferson City is 8 miles above the mouth of the Osage and 45 miles above Hermann.

Boonville is 51 miles above Jefferson City.

ARKANSAS RIVER.

The drainage area of the Arkansas River, including the White River, is 189,000 square miles. Arkansas River drains 185,671 square miles. (Census Bulletin.)

Pine Bluff is 172 miles above the mouth of the river, and Little Rock 176.

The Canadian River, the principal tributary of the Arkansas, enters half way between Fort Smith and Fort Gibson.

The Little Arkansas joins the main stream near Wichita, 409 miles above Fort Smith.

The Cimarron, or Red Fork, comes in on the right side, 228 miles below Wichita.

Grand River enters 87 miles below the Cimarron, and 94 miles above Fort Smith.

The White River has the Black River for its principal tributary, coming into it 336 miles above the mouth, half a mile above Jacksonport. Newport is 330 miles from the mouth.

The drainage area of Black River is about 8,000 square miles. The principal tributary is the Current River, entering a short distance above Pocahontas.

Caches River empties into the White River 1 mile above Clarendon. The Little Red River is a stream entering the White 30 miles below Augusta, Ark.

The distance from Fort Gibson to Fort Smith is 95.5 miles. Fort Gibson to Little Rock is 291.5 miles. Difference of level in low water at Fort Smith and Fort Gibson 104 feet. Between Fort Smith and Little Rock 160 feet.

The width varies from a small stream at low water to 1,500 or 2,000 feet at high water. The June rise comes from the Upper Arkansas and is remarkable for its red color. Ordinary high waters range from 18 to 25 feet, extraordinary, 27 to 35; at 26 feet there is damage to crops.

The valley of the Arkansas is in two terraces; the upper, the richer and more productive, has not been flooded since 1844.

The highest discharge observed at Little Rock for a gauge reading of 18 feet is 110,000 cubic feet per second. For the very high stage of 26 feet it is probably 150,000 feet.

From the Wichita to the Canadian River the low-water discharge varies from 500 to 1,500 cubic feet per second. The Canadian drains about the same area as the Arkansas above its junction.

At Fort Smith, January 24, 1887, for a gauge reading of plus 0.9 the discharge was 2,972 cubic feet per second.

Between Wichita and Grand River there are seven bridges without draws and two dams at Oxford and Arkansas City, 42 and 67 miles below Wichita.

The minimum discharge at Napoleon, "H. and A. report," is given as 2,318 cubic feet per second. At Pine Bluff the discharge is 4,400 cubic feet for a gauge reading of 1.3 feet at Little Rock, which would give minimum at Little Rock for low water, 2,500. At Little Rock, December 6, 1886, it was 4,365 cubic feet per second for a stage of 2.1 feet.

The width of the White River from Forsyth to Buffalo Shoals is fully 400 feet on the average. The height of bottom lands averages 23 feet above low water; the highest flood known, 28 feet, was pointed out by citizens of Forsyth. The discharge at extreme low water is 264 cubic feet.

At Kaw Agency, 102 miles below Wichita, the Arkansas River discharges 1,440 cubic feet at a 2-foot stage. The extreme low-water discharge of the White River at Jacksonport above Black River is approximately 1,000 cubic feet per second.

RED RIVER.

The distance from the source of the Red River to its mouth is 1,200 miles. It drains 97,000 square miles (89,970 according to Census Bulletin). The rainfall varies from 15 inches at the source to 65 at the mouth.

On both sides of the river and along its whole course there are continuous chains of lakes. These lakes are from 0.5 to 2 miles inland. They were at one time part of the river, and vary in depth from 8 to 15 feet, and in length from 1 to 2 miles. They act as reservoirs, maintaining uniformity of flow in the river.

The Kimishi empties into the Red, 155 miles above Fulton. The Boggy comes in 20 miles above the Kimishi. The Blue River comes in 35 miles above the Boggy.

The Ouachita, the largest tributary, comes into the Red 110 miles above the Kimishi.

Alexandria is situated at the Falls.

Coushatta is 160 miles above Alexandria.

Shreveport is 150 miles above Coushatta.

Fulton is 250 miles above Shreveport and 710 from the mouth of the river.

The Ouachita is the principal tributary coming into the Red River along its lower course. Being joined by the Tensas and Little Rivers it forms the Black River, which enters the Red River near its mouth.

The Little Missouri empties into the Ouachita 43 miles below Arkadelphia. Arkadelphia is 75 miles above Camden.

Camden is 240 miles above Monroe.

The Saline River is formed by the junction of the North, Alum, Middle, and South Forks, 25 miles south of Little Rock, and empties into the Ouachita near Marais Saline Landing. The river is 485 miles long.

RED RIVER OF THE NORTH.

The valley of the Red River of the North is about 225 miles east and west by 300 north and south. It contains approximately 67,500 square miles of area.

At Caledonia the flood stage is 39.6 feet above low water. The spring floods at Caledonia usually last ten days; they are sometimes caused by ice-gorges, but not often.

In the flood of the Red River of the North, April 12, 1862, at Moorhead the high water was 32.8 feet above the low water of 1879. This was due to an ice-gorge. The flood of 1881 was 1.5 feet lower. On April 25, 1882, the discharge at Moorhead, 15.5 feet below extreme high water, was 4,269 cubic feet per second. The flood discharge at the same point is estimated to be 20,000 cubic feet per second.

Eight miles by water below Elm River, Quincy, Dak., 100 feet above the Wild Rice River, the discharges were as follows:

1882.	Stage below flood.	Cubic feet per second.
May 18	23.3	5,276
May 23	25.3	4,150
May 24	25.3	4,016
May 26	25.5	3,710
May 27	25.7	3,675
May 29	26.0	3,399
May 31	26.5	3,515

The flood discharge is estimated to be 30,000 cubic feet per second; the flood stage is 36.2 feet above low water.

COLORADO RIVER.

The Colorado, formed by the Grand and Green Rivers, latitude 36° 17′, longitude 109° 50′, follows from that point a winding course for 900 miles, first 400 in the Grand Cañon and its extensions, the Black and Bowlder Cañons. It drains 240,000 square miles. The only tributary at low stages is the Gila, but 200 miles above the Gila it receives a good deal of water in times of flood from Bill William's Fork.

Very great changes occur; the river is 6 miles different in some places from what it was in 1857–'58. In great floods a change of 3 miles often occurs.

Yuma is 150 miles from the Gulf of California.

Discharge of Colorado at Camp Mohave, 11,610 cubic feet per second at lowest level in September, 1876. In January, 1879, estimated extreme low-water discharge, 3,000 cubic feet per second near same point.

At Yuma, in March, 1876, below the mouth of Gila, at low water, the discharge was 7,658.7 cubic feet, with a cross-section of 2,726 square feet; hydraulic radius, 5.8.

Michler, in 1854–'55, estimated the low-water discharge at same point to be 6,200 cubic feet.

June 8, 1877, a cross-section was 8,412.5 square feet; hydraulic radius, 15.3.

Topography and water supply.—"The Pecos River is a constantly flowing, heavily silted stream, running through an elevated country, yet in a depression of great extent. The altitude of Pecos is about 2,700 feet; the country to the west rises rapidly to Etholen, 127 miles west of Pecos, 4,650, and both to the north and west is mountainous. To the east, on the line of the Texas and Pacific Railroad, the country rises gradually to the station of Douro, 62 miles from Pecos, and is stated as about 3,100 feet.

"The Pecos River rises in a mountainous district, one branch in the Glorietta Mountains in the northern part of New Mexico, about 350 miles by air line northerly from Pecos, and during the irrigation season is largely supplied by the melting snows. Evidently the water seen in the Pecos River is but a fraction of the supply, the major part of which probably flows beneath the ground and in places breaks forth in springs. Within a month the entire river was dammed 6 miles above Eddy, 96 miles north of Pecos, yet with no water flowing over the dam, and the immediate bed of the river nearly dry, the flow at Eddy was not diminished appreciably, measurements taken showing the flow to have been 340 cubic feet per second. One spring at a distance of about 2.5 miles below the dam was estimated on February 9, 1891, by Col. E. S. Nettleton and Mr. W. W. Follett, engineers for the United States Government, as flowing approximately 30 cubic feet per second, or about 20,000,000 gallons daily.

"The lowest water in the river is during the months of December, January, and February; the highest during the months of June, July, and August (sometimes as early as May), or during the time when the water is most needed for irrigation." (Weather Bureau observer at Brownsville.)

WILLAMETTE RIVER.

At Portland, Oregon, at intervals of ten years on the average after severe winters a rise in the Willamette occurs. Twenty-eight feet above low water has been known; velocity, estimated, 8 miles an hour, ordinary high-water 4 miles an hour.

High water in summer is due to back water from Columbia River from snow melting in mountains. There is a bridge at Portland, Oregon.

The highest floods in the Willamette River are 30 feet.

DISCHARGE OF CONNECTICUT RIVER AT HARTFORD.

Stage.	Discharge.	Stage.	Discharge.
2	6,500	18	84,700
4	10,800	20	101,100
6	17,600	22	119,100
8	26,700	24	139,200
10	36,000	26	161,300
12	47,200	28	184,200
14	58,400	30	207,500
16	70,700		

SAVANNAH RIVER DISCHARGE.

Augusta stage.	Discharge in cubic feet per second.	Remarks.
5	1,000	Lowest summer water.
6	2,500	
8	6,100	
10	10,400	Ordinary winter flow.
15	22,700	
20	39,000	
25	59,600	
30	89,600	
32	110,000	
34	136,000	Freshet, 1864.
34.5	143,000	Freshet, 1887.
36	185,000	
36.4	202,000	Freshet, 1865.
36.8	220,000	Freshet, 1852.
37.5	258,000	Freshet, 1840.
38.7	300,000	Freshet, 1888.
39	320,000	
40	370,000	

Freshets in the Connecticut River usually occur in the spring; occasionally floods occur in every month except July and September. There was a remarkable exception in August, 1856, when the water at Hartford rose to 23.3 feet above low water.

The freshet of May, 1854, is the highest known below Holyoke, 29.8 feet above low-water mark on Hartford gauge. The freshet of April, 1862, was the highest known on Holyoke dam, and probably the highest in the river above that point; at Hartford 1.2 feet lower than in 1854. Previous to these floods that of 1801 was the highest; 27.5 at Hartford.

The run-off for the Connecticut River is .50 of rainfall over basin.

RIO GRANDE RIVER.

Reports of stages should be sent when a rise of 12 feet is indicated at Eagle Pass, 10 feet at Laredo, 7 feet at Carrizo.

Reports from Rio Grande should be sent to Carrizo and Roma, points above, no telegraphic communications however, and to points below Edinburg, Santa Maria, and Brownsville, all telegraph offices.

More than one telegram a day would be necessary in rises, as the river sometimes rises at the rate of 4 inches an hour.

There are three tributaries of the Rio Grande that cause high floods at Rio Grande City and which enter the river between that place and Laredo as follows: Rio Salado, that causes the highest floods, comes in at Carrizo; Rio Alamo that comes in about 10 miles above Roma, and Rio San Juan that comes in 1 mile above Rio Grande City at the Garcia Ranch. The last river is navigable and causes many rises.

On account of the sandy soil, the lowlands, and many great arroyas, a rise of less than 10 feet at Laredo does not affect the stage at Rio Grande City.

Guerrero is a large city in Mexico on the Rio Salado, 2 miles from its mouth, almost opposite Carrizo.

Laredo to Brownsville by river is 110 miles.

MISCELLANEOUS DISCHARGE MEASUREMENTS.

The maximum discharge of the Saone River in France is 29,065 cubic feet per second.

Discharge of Garonne River in France at low water, 5,800 cubic feet; at high water, 272,700 cubic feet per second.

The amount of water flowing in Bureau Creek at time of survey (1870) was not more than 50 cubic feet per second; West Bureau Creek was nearly dry.

The discharge of Gull Lake River on the 10th of November last (1874 ?) was 330 cubic feet per second.

St. Louis (?)—The discharge measured by Capt. McKeown is 368,747 cubic feet; mean depth 18; area of cross section 74,000 square feet.

The discharge of Big Black River is 6,000 cubic feet per second.

The drainage area of Gull Lake River is 235.97 square miles.

The drainage area of Pine River Basin is 503.64 square miles.

Gull River probably discharges 400 cubic feet per second.

The drainage area of the river for Dauphin Rapids is 39,246.5 square miles. In 1880 and 1879 the run-off was 0.373 and 0.296.

The discharge of Rocky River at lowest stage known is 3,426 cubic feet per second.

The Pine River is a rapid stream, which discharged at the low water of 1874 782 cubic feet per second. Its watershed is 788 square miles.

The Nishnabotana discharges 1,673 cubic feet per second at low water. The area of cross section is 1,299 square feet; mean depth, 11.55; mean velocity, 1.288 feet per second.

EVAPORATION AND RAINFALL.

Halley's value of evaporation at London, England, is 48 inches in a year. M. Cotte, at Montmorency, near Paris, gives 41.575 inches as the annual evaporation and 5.315 as that for a summer month.

Col. J. J. Abert's report on Chesapeake and Ohio Canal assumed 67.2 inches as annual evaporation for region.

Encyclopedia Britannica, Dalton gives formula for evaporation depending on dew-point and temperature.

Filtration in case of a canal is fourteen times the evaporation (Chesapeake and Ohio Canal).

Grass in growing consumes 0.10 of an inch of water; cereals require more water than forest; so that it would seem the cultivation of land diminishes the amount of water carried off by streams.

Mean daily evaporation at Leech Lake, Minn., 1879 to 1883, inclusive, April to October, both inclusive, 0.141 of an inch per day; at Wausau, 0.167 of an inch.

Very dry in Upper Mississippi Valley; no rain at Fort Ripley November 26, 1866, to April 13, 1867.

Dalton's percolation gauge gives at a depth of 3 feet in the earth about one-fourth of the rainfall.

Drainpipes gave one-third of rainfall as run-off from a depth of 4 feet. Other results give one-half.

Streams like the Chippewa, from sandy soils, keep up better in dry weather than from other soils.

The absolute amount of precipitation is less important than the circumstances which affect its loss by evaporation.

Evaporation in northern Minnesota, September: pan exposed 0.1040 inch per day; pan in shade, 0.0538 inch per day; pan in marsh, 0.0460 inch per day.

Average evaporation in lake region.

	Inches.
January	0.69
February	0.72
March	0.92
April	3.06
May	4.84
June	5.57
July	5.79
August	5.28
September	3.38
October	2.37
November	1.49
December	0.84

Total for the year, 34.95 inches. England, 32.68.

Lake Cochituate drains 19 square miles. The average run-off is 0.45 of the rainfall. In 1857, with 63.1 inches, it was 0.74, and in 1866, with 62.3, only 0.25.

Variations in rainfall are 35 to 69 inches, or 2 to 1; in run-off, 3 to 1.

Croton River drains 20 square miles; run-off, 0.63. Concord River drains 375 square miles; run-off, 0.41.

Lewis Brantz, in vicinity of Baltimore (1817 to 1824), observed rainfall average 39.89 inches; 1822, smallest, 29.2; the greatest, 1817, 48.55 inches.

The low-water discharge of the Potomac River at Chain Bridge just above Washington is 5,600 cubic feet per second: during the high water of April, 1891, the discharge was 178,000 cubic feet per second, during the great flood of June, 1889, the discharge was 470,000 cubic feet per second.

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APPENDIX 6.

REPORT OF THE OFFICER IN CHARGE OF STATE WEATHER SERVICES.

SIGNAL OFFICE, WAR DEPARTMENT,
Washington City, June 30, 1891.

SIR: I have the honor to submit the following report of the operations of the respective State and local weather services coöperating with the Signal Service during the year ending June 30, 1891:

There are thirty-seven States which at present receive the benefits derived from thirty weather services.

The most interesting and popular feature of the services, judging from the reports of the directors for the year, appears to be the Weekly Weather Crop Bulletin, which is of paramount value to farmers. Directors report numerous additional crop correspondents and a greatly increased weekly issue of crop bulletins. Monthly meteorological bulletins, too, seem to find great favor in the eyes of the public.

Each year the interest of each State in its respective service seems to increase, and it has been rarely found that any decrease of appreciation of the service and its workings has resulted. Boards of agriculture, boards of trade, chambers of commerce, meteorological institutions, and various bodies of similar nature, whether composed of business men, scientists, or farmers, give unfailing support.

The dissemination of weather forecasts and cold-wave warnings by telegraph, telephone, through the press, by railroad companies, and in various ways, has continued during the year, and a much higher estimate is placed upon such service, as the forecasts are continually becoming more reliable. The State weather services of Michigan and Wisconsin have added the greatest number of points to receive forecasts to their respective lists during the year.

The agricultural department of South Carolina having been discontinued, the financial aid given by the State was withdrawn, and the South Carolina State weather service is now supported wholly by the national service.

In September the headquarters of the Minnesota State service were removed from St. Paul to Minneapolis, and in October those of Colorado were changed from Colorado Springs to Denver, and new services organized during the year in Wisconsin and Maryland, the territory of the latter embracing the States of Maryland and Delaware.

Many of the directors report increased interest in the various special investigations pertaining to general meteorology, which investigations, differing much in the respective States, have been steadily pursued during the year, the study of irrigation receiving much attention in Western States.

The crop bulletin services in the States of California and Virginia still continue, and are favorably and heartily indorsed by the many farmers and other agriculturists to whom they are a benefit.

To the corps of well-trained voluntary observers and crop correspondents, who cheerfully give their time and service without compensation, is due great credit for their untiring zeal in rendering accurate and reliable reports, without which the Service would be at a great loss for means of obtaining much valuable meteorological data. To boards of trade, boards of agriculture, chambers of commerce, meteorological societies, and all of the various bodies of like nature are extended sincere thanks for their hearty and helpful coöperation in all matters pertaining to the furtherance of the better work of the Service; and to the directors of State and local weather services, and their assistants detailed by this Service, is due the greatest credit for their constant and often arduous labor in connection with their respective services. The faithful and effective manner in which their duties have been performed shows their special fitness in every way for work of this character.

Since my original suggestion, made to the Chief Signal Officer on January 27, 1881, for the organization of these services, with a view of making the work of the Weather Service of more benefit to the people, I have been continuously in charge of this branch of the Service until near the close of the current fiscal year, during which time there has been a gradual extension of these services, so that at the date of the transfer of the Weather Service from under the direction of the War Department these organizations were in operation in thirty-seven States. Organized as they are for the purpose of collecting and distributing information for the benefit of the farmers, the new administration of the Weather Bureau is furnished with the most complete system of distribution, which will enable it to carry out the provisions of the law requiring the extension of the work of the Weather Bureau in the interests of agriculture; and it is this object that I have constantly kept in mind during my continuous efforts to establish the local services coöperating with the national Service.

The assistance, both financial and otherwise, rendered by the national Service to these services has contributed in a great measure to their success, and has been courteously acknowledged by the officials of the various local services.

I am, very respectfully,

H. H. C. DUNWOODY,
Major, Signal Corps.

The CHIEF SIGNAL OFFICER OF THE ARMY,
Washington, D. C.

ALABAMA.

[Central office, Auburn; Prof. P. H. Mell, director.]

The following is the report of the Alabama weather service for the year ending June 30, 1891:

The past year has been consumed in continuing the equipment of the stations with standard instruments and in organizing new stations in other parts of the State; in publishing the regular bulletins of the service and in collection and preparation of material for special bulletins on problems relating to the climate and the farming interests of the State.

The work in Alabama may be divided into the following heads:

(1) The collection of meteorological data by voluntary observers, judiciously located over the State. This material when sent in to the central office is carefully compiled, under the supervision of the director, and published in the bulletins of the service.

(2) During the crop season, extending from May 1 to November 1, the observers make special reports each week showing the condition of the growing crops and the effects of the weather on the same. These reports are used in the preparation of the bulletins that are sent out on Saturday mornings during this period.

(3) From the large amount of material collected during the past few years of the existence of the Alabama service, several bulletins have been compiled and issued from the central office relating to climatic problems.

A meteorological station was established at Auburn in February, 1881, by the authorities of the Alabama Polytechnic Institute, and Prof. P. H. Mell was placed in charge of the station. In 1884 Auburn was made the central station of the Alabama weather service; and in March of that year a bulletin was issued containing data from 22 voluntary observers. In a few months the number of observers was increased to 45. During the first two years there were many difficulties to contend with in placing the service on a firm basis; and doubts were frequently entertained by outside parties whether the service would last long. There was no money with which to pay expenses of publication of the bulletins and to purchase the necessary instruments for the use of observers. Immediately upon the organization of the service the State commissioner of agriculture was urged by the director to receive the manuscript of the bulletins each month, and publish them as a part of the transactions of the department. This he finally consented to do. This trouble having been surmounted, the effort was now made to secure first-class and uniform instruments for the stations. This was not successfully accomplished until the Chief Signal Officer, in 1888, kindly consented to lend to the State a sufficient number of maximum and minimum and exposed thermometers and rain gauges to equip one station in each county. Up to this time observers had furnished their own instruments.

In 1885 the commissioner of agriculture withdrew his support, and the publication of the bulletins was transferred to the printing office of the college by the special enactment of the board of trustees.

Alabama has the honor of inventing the system of signals for indicating the changes of the weather. After being used in this State for a year or more, it was finally adopted by the Chief Signal Officer for the entire United States.

The service as organized consists of forty-three stations, all of which are equipped with standard instruments. These stations have been carefully located so as to cover as nearly as possible the entire State. Since the organization of the work in Alabama, in 1884, eighty observers have reported data to the central office at Auburn.

ARKANSAS.

[Central office, Little Rock; Mr. M. F. Locke, director; F. H. Clarke, assistant to the director.]

Col. M. F. Locke, commissioner of mines, manufactures and agriculture for the State of Arkansas, has remained director of the weather service during the year. Corpl. W. U. Simons, his assistant, was relieved October 18, 1890, by Sergt. F. H. Clarke, who is at present assistant to the director.

The service has remained entirely dependent on the Chief Signal Officer for support. A bill asking for a small appropriation for its support, was drafted and handed to a member of the last legislature, but owing to existing circumstances it was thought advisable not to present it at this session, thus leaving the service without a chance of an appropriation for two more years. The number of stations has been increased from 25 to 34, and a marked improvement is noted in the accuracy and promptness with which reports are made and forwarded. Stations from which reports could not be obtained regularly have been closed and the instruments called in. Through the courtesy of Prof. W. S. Thomas, of the Iron Mountain land department, the monthly reports were published from July 1, 1890, to May 31, 1891 in the "Forest and Farm," a monthly periodical devoted to the interests of the State. On May 1 the commissioner of agriculture commenced publishing a monthly report entitled "Monthly Review Bulletin and Crop Report of the Arkansas Bureau of Mines, Manufactures and Agriculture, coöperating with the United States Weather Bureau." In this review three pages were allotted to the State weather service for meteorological data. The monthly issue is 1,500 copies, which are distributed gratuitously throughout the State.

The weekly weather crop bulletins are issued from March 14 to December 1, and continue to be the feature of the service. At the beginning of the present crop season over 300 circular letters were issued asking for crop correspondents, and never in the history of this service has there been such an extensive list of crop reporters as at present. The list now comprises 150 regular correspondents, and reports are received from nearly every county in the state where mail facilities are such as to allow the reports to be received in time for publication. The weekly issue of crop bulletins is about 250, and requests are continually coming in for additional copies. All State weather service centers are furnished with a copy, as also numerous mercantile exchanges throughout the country. The bulletin is mailed Saturday afternoon, is published in full in the local newspapers, and a synopsis in many State papers, and in Memphis, Tenn., and New Orleans, La.

Through the courtesy of the several directors of the State services this office has been able to furnish the Board of Trade with copies of the several weather crop bulletins issued by them. These bulletins are posted in a place set apart for the purpose, are carefully read and highly appreciated.

There are thirteen points in the State where daily forecasts are received and signals displayed. During the year two display stations were discontinued and four established. The forecasts are also telephoned to six points in the State free of charge through the courtesy of the telephone companies. In the berry and fruit-growing sections of the State the forecasts are thought most highly of. Shippers of fruit and vegetables are also greatly benefited. One gentleman informs the office that several thousand dollars were saved him during the past year by a knowledge of weather conditions obtained from this office.

Particular attention has been given during the present growing season to insect pests, particularly those infesting cotton and corn. To this end 200 circulars were sent out over the State asking for information. Thus far crops have been unusually free from all insects and consequently but few replies have been received. The information gathered has been forwarded to Prof. F. W. Mally, United States entomologist, Shreveport, La.

The compilation of data collected by the State service and from other sources had never been attempted until October last, when it was found necessary to have certain data collected and tabulated in a form easy of access. Since then tables have been prepared showing the mean temperature, maximum and minimum temperature, and total rainfall at each station for the months from October to June from 1883 to 1891, inclusive. Tables containing like data for July, August, and September will be completed early in the ensuing year.

CALIFORNIA.

[James A. Barwick, director.]

The crop-bulletin service of this State is very well received by many people throughout the State, and the secretary of the State agricultural society and myself are making every effort to render this service both popular and useful. The secretary has some 200 copies of the bulletin printed each week at the State printing office, most of which are distributed throughout the State, about 40 copies being sent east of the Rocky Mountains.

Owing to the length of time required for weekly crop reports from the southern part of the State to reach Sacramento, Mr. G. E. Franklin, observer in charge of Los Angeles, was given authority to establish a crop-bulletin service for southern California, issue a weekly bulletin, and to forward to me a telegraphic summary each Saturday, for publication in the bulletin for the State. The bulletin issued at Los Angeles has met with great favor, and upon the request of the Board of Trade, Chamber of Commerce, Produce Exchange, and many prominent business firms of that city, the weekly crop bulletin for southern California will be continued during the entire year, as in that section of the State crops are maturing during all seasons of the year.

COLORADO.

[Central office, Denver; Wm. S. Miller, director.]

The following is the report of the Colorado State weather service for the year ending June 30, 1891:

The collection of meteorogical reports from voluntary observers was begun in the spring of 1885, under the direction of the Colorado Meteorogical Association. Prof. Short, of Denver, was in charge of the work at first, and he was succeeded by Prof. Loud. The central office was moved from Denver to Colorado Springs when Prof. Loud took charge of the work. The Signal Service detailed an assistant to the director of the local service in the spring of 1887. The first assistant was Sergt. T. W. Sherwood, and he was relieved by Sergt. W. S. Miller in October 1889. December, 1890, the central office was moved to Denver, and since that date W. S. Miller has been director of the service.

The number of voluntary stations reporting at the end of the present fiscal year is 107, of which 64 report temperature, precipitation, wind, and clouds, and 43 precipitation only. All stations report such miscellaneous phenomena as may be of interest. The reports of voluntary observers are received with very fair regularity, and are, as a rule, rendered with much care. The list of stations since 1886 has increased annually as follows:

1886	11
1887	20
1888	31
1889	36
1890	90
1891	107

The instruments at voluntary stations are for the most part Signal Service property, though some forty of the rain gauges in use are Geological Survey property. However, all instruments are standard, except a few located on the line of the Union Pacific Railway, and at these stations the thermometers are owned by the railroad company.

A wide distribution is given the monthly bulletins. All reports are manifolded by the cyclostyle process. The greatest interest is manifested in the weekly weather crop bulletins; they are not only looked upon as a reliable summary of crop conditions for the week, but are also serviceable as a legitimate means of advertising the agricultural possibilities of the State. Owing to the lack of railroad and mail facilities, there is some difficulty in collecting more data for the bulletins, but every available source of information is utilized to the fullest extent.

The newspapers of Colorado have been the medium, to a very large extent, through which the Weather Bureau reports reach the public, and it is a pleasure to know that the aid of the press in this direction has been freely given; space is never denied, neither in the large metropolitan journals nor in the smaller country papers of the State. In return for many favors thus granted, it has been the aim to always cheerfully and promptly comply with any request for special data from newspaper men.

The work of the service is now very highly appreciated in the state. Its value is being more and more recognized. The study of meteorological data has a prominent bearing on the solution of all irrigation problems. Then, again, the Rocky Mountain region is a natural sanitarium, whose health-giving properties are acknowledged both at home and abroad. There is, in fact, much work that can be done which is peculiar to a great extent to Colorado alone.

A great deal of precipitation data has from time to time been furnished the state engineer. A most important subject, in which many are now interested, is the gathering of statistics during the winter, showing the depth of snowfall in the mountains. It is obvious that it is difficult to obtain these data, and success will be hard to achieve; the result last winter was very unsuccessful. The director is now preparing plans to make another effort the coming winter by a different scheme. If the snowfall during the winter and spring, especially the former, were known with some degree of accuracy, it might be possible to forecast the probable water supply in irrigable valleys from time to time. The location of water gauging stations along the streams during the spring and summer would also have to be developed and evaporation observations made at a number of places.

ILLINOIS.

[Central office, Springfield; John Craig, director.]

The report relative to the work of the Illinois weather service, for the fiscal year ending June 30, 1891, is as follows:

But little change has been made in the work of this service during the past year. Reports are still being received from about forty voluntary observers monthly. Forms 1011 and 1012, compiled from the reports received, were forwarded to Washington on the 15th of each month.

A monthly report, cyclostyled, has been issued during the year, and distributed among the observers reporting, and to the various State weather centers. A summary of the monthly report is also issued to the principal newspapers throughout the State.

Two hundred and twenty crop bulletins have been issued weekly, during the growing season, to the observers reporting and to the principal newspapers.

These bulletins are now being published in full by the leading papers of Chicago and St. Louis. This part of the work is greatly appreciated by those interested. The data used in making up these bulletins is also furnished by the voluntary observers, reports being received from about twenty-seven counties.

Weather forecasts and warnings are still telegraphed daily, except Sundays, at the expense of the Government, to the leading points in the State, and as a general thing have been greatly appreciated by the citizens. The average dates of harvesting and planting principal crops in Illinois are, wheat, planting September; harvesting about June 15. Oats, planting May 1; harvesting about July 15. Corn, planting May 10; harvesting about November 1.

INDIANA.

[Central office, Indianapolis; Prof. H. A. Huston, director; C. F. R. Wappenhans, assistant to the director.]

The Indiana State weather service was organized in 1882, the first considerable report from any considerable number of counties being received in June of that year. The service was under the direction of J. B. Conner, then chief of the Indiana department of statistics. Capt. Conner devoted much time and attention to the collection and publication of the meteorological statistics, and since his connection with the service has been severed he has been of much value and assistance to it. In 1881 he published a collection of meteorological statistics in the report of the Indiana bureau of statistics, and in 1882 appears the first regular report of the service. In 1883 the service was transferred to Purdue University, and was under the direction of Prof. W. H. Ragan until July, 1884. Since that time it has been under the direction of Prof. H. A. Huston. In March, 1888, the service was transferred from the University to the Agricultural Experiment Station, a department of the University.

Regular monthly bulletins have been printed and distributed since September, 1884. For the past four years regular weekly crop bulletins have been issued during the growing season.

It is believed that the publications of the service are appreciated by the people of the State, and particularly the weekly crop bulletin. It has a very extended circulation through the medium of a number of newspapers, which publish this crop report either complete or in part.

Display stations maintain their popularity, and the people of the State depend upon them more and more each year for business purposes. The demands for telegrams to the display stations has always been greater than could be furnished.

The regular monthly bulletin is arranged to include both the statement of the conditions during the month and a comparative table for the same month for periods varying from four to thirty-six years.

The service is indebted to the United States Signal Service for the services of the assistant, Mr. C. F. R. Wappenhans.

Great appreciation is expressed of the services rendered by the volunteer observers, who furnish the material from which reports are compiled.

IOWA.

[Central office, Des Moines; Mr. J. R. Sage, director; George M. Chappel, assistant to the director.]

The Iowa weather service was established in 1875, as an independent organization of voluntary observers, under the directorship of Dr. Gustavus Hinrichs, of Iowa City, then a professor in the State University. In 1878 the General Assembly, recognizing the value of the service to the people of the State, appropriated $1,000 a year to defray a portion of the necessary expenses of its maintenance. It was operated, however, on an independent line, and the State thereby failed to secure the benefit of reciprocity and coöperation with the National Weather Bureau. To remedy this defect, and to increase the efficiency of the service by adding a provision for the collection, tabulation, and publication of crop statistics, the General Assembly in 1890 repealed the act of 1878 and passed a substitute providing for the establishment of the Iowa weather and crop service, under the supervision of the directors of the State agricultural society, coöperating with the Weather Bureau of the United States.

The result, it is confidently believed, fully justifies the act of reorganization, and demonstrates anew the wisdom of the proverbial maxim, "In union there is strength." In this line of public service, as in all others, the State is the recipient of the larger measure of the benefits of union.

Monthly reports of meteorological data are now received at this office from 91 stations, including the 5 Signal Service stations within the State, and 2 (Omaha and La Crosse) in adjoining States. Weekly weather crop reports are received from 145 voluntary observers, the larger number of whom are supplied with rain gauges and report precipitation for the weekly bulletin. During the crop season monthly reports of acreage and condition of staple crops, etc., are received from 1,025 correspondents, an average of over 10 in each county. These reports are tabulated for the monthly review, and advance sheets are sent to the press of the Northwest.

Of the monthly review there were issued within the past year 23,000 copies. The total issue of the weather crop bulletin during the year (twenty-five weeks) was 31,000 copies; an average of a little more than 1,200 per week. The public appreciation of their value is expressed by letter, by frequent commendatory notices in the press, and by the continued increase on the mailing list.

The intelligent farmers of the State are especially interested in the weekly bulletin and monthly crop reports, having learned their value in estimating the output of the harvest and its probable effect upon prices of farm products.

During the past year this service, ably assisted by Prof. L. H. Pammel, of the Iowa Agricultural College, has made a special study of the fungous diseases of Iowa forage plants, and the results have been given to the public in a series of illustrated articles published in the monthly review. It has also investigated the subject of artesian wells within the State, with the view of mapping the areas of artesian probability. This work has been carried on by Prof. R. Ellsworth Call, a geologist of national repute.

It has been the aim of the director to make the monthly review interesting to students and the general public, as well as to scientists and statisticians.

The daily forecasts are received, and the signals are displayed at 51 stations. Numerous letters received and on file at the Des Moines office indicate that this gratuity on the part of the Government is highly appreciated by the people of the towns served with these daily forecasts.

This service has sent out to voluntary observers during the year thirty-six standard rain gauges, which, added to the number loaned by the Signal Service, furnish the means of obtaining reliable measurements of precipitation in nearly every county in the State. This is regarded as the most important feature of the monthly weather reports.

KANSAS.

[Central office, Topeka; Prof. J. T. Lovewell, director; T. B. Jennings, assistant to the director.]

The weather service of Kansas has been performing its work during the past year on the same basis as heretofore, and with the substantial result of securing an authentic record of the climatic conditions of the State for the current year.

Including the 4 Signal Service stations, there are reports received from 79 stations, representing 65 counties. There is a considerable falling off in the number of observers as compared with last year, owing to various causes, such as deaths, removals, pressure of other duties, lack of interest, all of which may be expected in a volunteer service.

The year 1890 was remarkable for deficiency in rainfall, and in the months of July and August for very hot weather, and the consequent failure of the corn crop, which intensified the depression of business due to other causes. One result of all this was that some of the observers tired of the monotonous record of hot and dry weather and ceased to report. Doubtless recruits will be made in the future, and it is still hoped to secure observers and reports from each of the 106 counties in the State.

The work of making reports and tabulating results has been in the hands of Sergt. T. B. Jennings, detailed from the Signal Service for such assistance. Mr. Jennings has also traveled extensively through the State, giving instructions to observers and collecting facts of general interest relative to storms, crops, winds, rainfall, etc.

The time proved unfavorable last winter for securing legislation that would place the weather service more directly under State patronage and support. It is hoped and expected, however, that the State will give such recognition as will be of great advantage to the efficiency of the service.

There are many questions of great interest relating to irrigation and rainfall, and a careful study of facts will in many cases obviate the need of costly and fruitless experiments to sustain vague theories.

There is much need of popular information in the nature and use of forecasts as furnished by the Signal Office. This information can only be given by reiteration and a gradual formation of the habit of looking to these forecasts as one of the common dictates of prudence in ordering one's affairs.

The display of weather signals on moving trains has been attempted to a limited extent by the Rock Island road, and with a proper popular understanding would prove of great value. The various railway corporations have shown themselves ready to coöperate with the service in all ways that promise tangible results, and these train signals are regarded as worthy of study and development.

KENTUCKY.

[Central office, Louisville; Dr. E. A. Grant, director; Franke Burke, assistant to the director.]

That the Kentucky State weather service is not properly appreciated and has not received from the State authorities the means to thoroughly equip it for its greatest possible usefulness, is a source of regret and mortification, not only to the director but to many intelligent citizens throughout the State.

The service was originally established at Lexington and observers were appointed in various sections of the State to whom instruments and the necessary blanks were furnished, but very few of them were found competent and willing to make proper reports.

In July, 1888, the central office of the service was moved to Louisville and placed in charge of the Polytechnic Society of Kentucky. The instruments in the hands of incompetent or careless persons were called in; new observers were appointed as fast as competent ones could be obtained, and a persistent effort has continually been made to secure the best possible observers in different parts of the State. The effort has not been as successful as desired, but a corps of faithful and competent observers is gradually being secured.

The service has now 22 observers and 80 crop reporters, most of whom discharge the duties thus voluntarily assumed with an intelligence and zeal worthy of all praise.

The Polytechnic Society of Kentucky undertook the publication of a State weather service bulletin and maintained it for one year, believing that the State legislature would provide the requisite funds to continue its publication and otherwise aid the State weather service in its important work. A bill was prepared for legislative action, and its passage was urged by prominent citizens and the leading commercial organizations of the State; but ignorance, prejudice, and indifference killed the bill. After this the Polytechnic Society declined to continue to meet the expense of publishing the bulletin. Since that time Sergt. Burke has, by his duplicating process, issued a regular weather report, and, during the season, crop reports. Both the weather and crop reports printed by this process have been widely circulated, and applications for them continue to increase. It is believed that this interest will soon reach the ears of our legislators and result in a well-endowed weather service.

The system of frost warnings established in 1889 has been of incalculable value to the planters of the State, and, except in one or two small localities where the temperature was affected by local causes, the predictions have been in every instance verified.

It is surprising how many difficulties have to be met in the effort to establish a State weather service on a suitable basis. It will require time to overcome them all; but indifference and ignorance must yield to the logic of facts, and an enlightened self-interest will demand a liberal appropriation for this important purpose.

LOUISIANA.

[Central office, New Orleans; George E. Hunt, director.]

The following is the report of the Louisiana State weather service, for the year ending June 30, 1891:

This service has never received any financial or other aid from the State, and has been conducted during the year just closed, as in former years, under the auspices of the agricultural and commercial associations of Louisiana, by the Signal Corps observer in charge.

There were 49 stations in operation June 30, 1890, and at this date reports are received from about the same number.

Being unable, on account of a lack of instruments and clerical assistance, to establish new stations or to inaugurate any decided improvement in the methods of tabulating and making public the data collected, and believing that absolutely correct reports from a limited number of properly-distributed points throughout the State would answer every purpose sought by the Government and be of far more value than a mass of data collected by inexperienced and poorly-instructed observers, the efforts of the office have been constantly directed toward improving the character of the reports received. Every opportunity has been embraced to impress upon voluntary observers the importance of accuracy and uniformity, and it has been sought, by relieving them of all work except the mere recording of their observations, to make their duty as light and pleasant as possible. Great care has been exercised in the distribution of the few instruments at the disposal of the office, and no pains have been spared in instructing observers in their proper care and handling. Careless and incompetent observers have been requested promptly to turn in their instruments that they might be placed in the hands of those who were willing to manifest their interest in the service by good work.

The weekly crop bulletins continue to be by far the most popular feature of the service, and all information contained in them is eagerly sought by the press, the commercial and agricultural organizations, and, to a constantly-increasing extent, by the general public. One hundred and twenty copies are issued each Saturday during the crop-growing and harvesting season, and are distributed by message and through the mails. Eight daily papers in this city alone reproduce in their Sunday edition every bulletin that is issued, word for word, and the information is also given wide dissemination by the country press and through the columns of the Southern Presbyterian, a weekly religious publication, which has a large circulation throughout the entire South.

The publication of the monthly reports through the Louisiana Weather Journal, a monthly publication supported by private enterprise, has been continued during the year, and through this medium reaches the public on the 10th of each month. Fourteen hundred copies of the Journal are issued monthly, and the greater number are distributed gratuitously throughout this and the adjoining States. Reporters from the local press each month scan the proof slips of the Journal and reproduce in the columns of their several papers the general summary and all other meteorological data, exclusive of the large temperature and precipitation tables. On several occasions when the advertising patronage of the Journal had decreased to such an extent as to make it seem likely that the Signal Corps director would be put to personal expense to continue its publication, the New Orleans Cotton Exchange, through the chairman of its meteorological committee, has proffered financial aid, and offered to assume responsibility for cost of printing, but as all the other bodies were equally interested in the work, and share jointly in whatever benefits are derived from it, the director did not think it wise to put the service, which is but an adjunct of the national service, under so much obligation to any one organization, and its generous offers have been declined, except to a very small extent, and only when all the other commercial bodies have subscribed equal amounts. A total amount of $45 has been subscribed and collected jointly from the four agricultural and commercial bodies of New Orleans during the year. This sum has gone toward defraying the expense of publishing the data of the service, and has served to secure the director from personal loss, and in a large measure to relieve him from the necessity of canvassing for advertising patronage for the Journal.

Data has been compiled during the year from the State service reports for the immigration edition of newspapers; for parties outside the State intending to emigrate to New Orleans; for the city press; for the commercial and agricultural associations of the State, and occasionally for planters and farmers, many of whom are beginning to manifest an interest in the climatic data of the service, and are generally anxious to compare the temperature and rainfalls of those years most favorable and most unfavorable for such crops as they are particularly interested in. Requests for such information have always been cheerfully complied with, even when they have entailed a great amount of extra labor. Every effort has been made to keep alive and stimulate interest in such matters.

Crop prospects, owing to the protracted drought during the spring months, looked very gloomy up to three weeks ago, but since that time generous rains have fallen in all sections of the State, and it is now generally believed that the damage resulting from the drought will be much smaller than was at first supposed, and will be principally confined to early planted corn and unimportant crops. With a favorable season from now on, an abundant yield from the cotton and sugar-cane crops may be reasonably expected. Late corn also promises well.

The average dates of planting and harvesting are as follows: Cotton, planted March 1 to June 1; harvested from August 15 to January 1. Corn, planted from February 14 to June 1; harvested from September to November. Sugar cane, planted from September to March; harvested from October to January. Vegetables, planted from September to February; harvested from March to July. The above are the chief crops. Cane is planted at any time from September to March, sometimes the season carrying it well into March. Cotton and corn are frequently delayed by water, and not planted until June. Vegetables are planted mainly in the fall and winter and marketed in the spring.

The service is self-sustaining, and can be continued as heretofore should the Chief Signal Officer so desire.

MARYLAND.

[Central office, Johns Hopkins University, Baltimore; Dr. William B. Clark, director; C. P. Cronk, assistant to the director.]

The operations of the Maryland State weather service in the fiscal year ending June 30, 1891, included little more than the work of organization, and it can scarcely be said that even this is finished. The matter was discussed in April by representatives of the Johns Hopkins University, the Maryland Agricultural

College, and the U. S. Weather Bureau, and it was decided to organize a State service, to include Maryland and Delaware, under the auspices of the three institutions. The Johns Hopkins University was agreed upon as the place for the central office, and by the authority of the Chief of the Weather Bureau an office was opened there on June 1. Meteorological reports for the month of May were received from twelve stations, which had previously been reporting directly to the U. S. Weather Bureau, and a monthly summary and report of operations, together with a preliminary statement, was prepared, printed, and circulated. The proof constituted an octavo book of 12 pages, but was reduced to 10 pages, and then printed. Meanwhile crop bulletin forms had been sent out and the initial reports were received for the week ending Friday, June 26. The first weekly weather crop bulletin was issued on the succeeding day, June 27. Copies of both the weekly and monthly reports were sent to every newspaper in the States of Maryland and Delaware, and to some in the District of Columbia. They were otherwise given a wide circulation. The weekly bulletin was published in full by the Baltimore dailies and by other papers in the States. There were also many commendatory editorial notices, and a number of encouraging letters have been received.

This fair beginning has been somewhat checked by the lack of an understanding in regard to the expenses for printing, which, it is likely, can not be corrected until September, and the outlook is that until that time the monthly report will be limited to 2 octavo pages. The expense of this printing will be borne by the university, as was the expense of printing the first and larger monthly report and the first weekly bulletin. As there is no fund for the further printing of the weekly bulletin it is published in the daily produce report, the organ of the Corn and Flour Exchange. This sheet is not a newspaper, so that no jealousies are engendered by the mode of publication. The weather crop bulletin is given the most prominent place in the publication. The outlook for the future success of the service is encouraging. It is thought that the publication of fuller reports can be begun in the autumn, by which time it is hoped to have observers in every county in the two States. Two base maps of Maryland and Delaware are being prepared at the office of the U. S. Geological Survey, Washington, for use in future reports. They will cost $150, the expense being borne by the Johns Hopkins University, the Maryland Agricultural College, and the U. S. Geological Survey.

The State service will be of value in different ways. It will afford opportunities for the closer study of the climate of the territory embraced than heretofore has been possible; and as the climate of the eastern portion is not only marine but insular, and that of the western portion not only continental but mountainous, opportunities are offered which are possessed by scarcely any other portion of the country. Under the very liberal policy of the present Chief of the Weather Bureau as many points as possible for the display of forecast signals will be established. It is thought that this project will be of great value to the marine interests of Maryland, and several points will be selected upon the coasts of the Chesapeake and Delaware bays and their tributaries and upon the Atlantic coast. A special effort will be made to make the service of value to agriculture, and through the medium of the press it is hoped that interest enough can be stimulated to effect the display of weather signals at all prominent points in the interior.

MICHIGAN.

[Central office, Lansing; N. B. Conger, director.]

The Michigan State weather service was established by act of legislature February 3, 1887, and was placed under the control of the State board of agriculture, with Sergt. N. B. Conger, detailed by the Chief Signal Officer, as director, and has since been operating under that and similar acts passed in 1891.

The work of the service has been to establish observing stations in each county of the State, as far as possible, and to collate the information derived from these stations and publish it for the information of the public generally.

During the period that this service has been in operation there have been compiled the monthly rainfall and temperature charts of the State, showing the distribution of the same over the State and the consequent effects, as far as they have been determined, upon the different cereals of the State.

The director has now under study the "frost lines" of the State, showing the different divisions where frost during the different seasons of the years is most likely to occur first and the probable intensity of it. In the preliminary study of this subject many new and important features have been developed which will be of undoubted value in making frost predictions for the State at large and for localities.

There have been in the past years some isolated stations in the State making monthly reports, some regularly and others at irregular intervals, and this information has been in such shape that it could not be readily used in studying the climate of the State. These reports have all been compiled and the information relative to the rainfall and temperature has been entered on sheets for binding, so that all the temperature and rainfall data of the State can be bound into one volume and be used for ready reference when needed.

In the study of the climate of this State the rainfall and temperature charts have been of great value, as the information is placed in such shape that it can be easily understood and appreciated by the masses, and does not necessarily take a trained meteorologist to extract the value of the information so that it may be used.

The study of these charts relative to the "peach belt of Michigan" shows conclusively the immense importance of the temperature and rainfall on these fruits, and why they can be readily raised along the west shore of the State in such abundance and are not so plenty in other sections. The prevailing high temperature during the winter and the low temperature during the spring of the year, which is essentially necessary to the protection of trees and buds from early frosts, is graphically depicted on the charts; and, again, the air drainage of the west shore is also very favorable to the growth of peaches and small fruits.

The study of the difference of the minimum temperature in the instrument shelters and on the ground has also taken up no little time of the director, and with a more extended observation of this work will undoubtedly show an average difference between these temperatures which will be of no little value to the proper forecasts of frosts in the different portions of the State.

The study of local rains in Michigan has received some little attention.

The above constitute the several studies which this service is now engaged in for the advancement of the work, and so far the results have been quite satisfactory.

The corps of voluntary observers still holds the high standard which they set in the years gone by, and to their untiring efforts in carefully taking and preparing their reports is due in a great measure the success which has been attained in this service relative to the climate of Michigan.

There have been some changes during the year in the personnel of the voluntary observers, but the changes have been but few and the number is but eight below that of last year at this time. The majority of the observers have been connected with the service since its establishment.

It is here fitting that the thanks of the service should be bestowed upon these observers who have been so faithful in their work and have rendered such regular and uniform reports during the year.

The practice of having a small sum for the expenses of the voluntary observers' stations during the past two years has been of no little benefit to the service and to the observers, and it was with sincere regret that it was found impossible to continue this, there being no further appropriation for this purpose.

The weather signals have been displayed in sixty towns during the year, and the steady improvement of the forecasts have made this class of work more satisfactory to the people during the year. The verification of the official forecasts for the year ending December 31, 1890, for Lower Michigan was 85 per cent.

On January 1, 1891, the stations which had been receiving the forecasts at the expense of the State were all transferred to the national Service, and have since been carried on by that Service, and the small appropriation of the State service for this work was expended in supplying signal flags for the stations, which has proved more successful in retaining the displaymen than the old system, where the towns were expected to supply the flags for the display of the signals.

At the close of the year there are 51 stations receiving the forecasts through the Lansing office at the expense of the national Service.

The weather crop bulletin was continued until the last Saturday in September, 1890, when it was discontinued; in April, 1891, it was resumed and has been published each Saturday morning regularly, and sent to some 400 places in and out of the State. This bulletin consists of the bulletin proper, containing the normal temperature, departure therefrom; average total rainfall for the week, and departure from the normal; amount of sunshine, and the general results on all the cereals. Accompanying this bulletin is a rainfall chart showing graphically the distribution of the rainfall over the lower peninsula during the past week.

As the object of this bulletin is becoming more and better understood, there are more calls for it and the opposition to it is fast disappearing. The farmers are beginning to realize the value of the report each week to them, and during the past winter at the different farmers' institutes the weather service and crop bulletin were freely discussed, and were in all cases recommended for their usefulness. It is considered that this report is one of the most valuable that the service issues.

The bill for the expenses of the weather service for the two years ending July 1, 1892, failed in passage in the senate on a close vote, and it is not probable that at this late date it can be carried through successfully.

The amount asked from the senate for the expenses of the service for the next two years was $2,600, or $1,300 a year.

The service has been in operation for four years, and has been indorsed by the State Grange, Patrons of Industry, and the State Horticultural Society, and the many people who have access to the information published by the service.

MINNESOTA.

[Central office, Minneapolis; Willis L. Moore, director.]

The Minnesota State weather service was established in December, 1884, with headquarters at St. Paul. On December 23, 1890, the headquarters of the service were moved to Minneapolis, Minn., and Mr. John Healy assigned in charge. Mr. Healy was relieved on June 22, 1891, by Mr. Willis L. Moore. On December 21, 1890, an assistant, Mr. H. W. Ford, was employed and was found to be thoroughly competent for any duty at the station.

The Minnesota service is maintained wholly by the U. S. Weather Bureau, the State furnishing no funds whatever toward its support.

A deep public interest is manifested in the work. When the weekly crop reports are received on Saturday morning it is of usual occurrence to see the reporters of the evening papers copying the reports from sub-stations as fast as received, so anxious are they to get the full report before the official can complete his summary of the crop conditions.

These crop reports are published in all the daily and weekly papers of Minneapolis and St. Paul, and by most of the county papers throughout the State; also by the Orange Judd Farmer, published in Chicago, Ill.

On account of the immense cereal-producing districts of this State and the adjoining ones, the Chamber of Commerce feels a vital interest in the crop reports, and desire a complete and extensive service. The receipts and shipments of wheat alone were 45,000,000 bushels for the year ending December 31, 1890, and the indications are that this vast amount will be greatly exceeded the present year. The magnitude of the grain interests of this city will be better understood when it is known that the total receipts of Chicago, Duluth, and St. Louis for the corresponding period were 39,000,000 bushels, 6,000,000 less than handled by this city alone. These figures are cited to show the reason for the general interest taken in all weather reports affecting crops.

Forty crop correspondents throughout the State are in regular communication with this office; 18 voluntary observers take daily observations and make monthly reports; also 5 regular Signal Service stations forward either weekly or monthly reports of daily observations, making 23 stations from which meteorological reports are received. Three new stations have been established and one discontinued during the year.

MISSISSIPPI.

[Central office, University; Prof. R. B. Fulton, director.]

In 1885, after correspondence with the Office of the Chief Signal Officer, Prof. R. B. Fulton undertook the work of organizing a corps of voluntary observers in this State. He was furnished with necessary stationery and franked envelopes, and with the daily cotton region bulletins of the centers, including this State.

Earnest efforts to induce the legislature of Mississippi to furnish the means to equip volunteer observers with instruments were unsuccessful, although the matter was brought to their attention by the Governor in a special message on two occasions.

A few bulletins were published in the newspapers, and a few volunteers began observations with their own instruments.

In 1887 (September) the Chief Signal Officer detailed a member of the Signal Corps to coöperate in the work, and soon afterwards was able also to supply some thermometers and rain guages. The University of Mississippi furnished an office, and in 1888 began to bear the expense of publishing the monthly bulletins.

In December the present director became a member of the Signal Corps and was placed in charge of the work, and has thus continued since December, 1888.

Within the last two years the number of regularly reporting observers has grown to 28, all but 3 of whom are supplied with standard instruments. The monthly reports of these observers (on Form 1009-Met'l) are consolidated into a monthly bulletin and summary, printed at the expense of the University of Mississippi and the director. With the above-mentioned reports are consolidated also reports from the regular Signal Service stations in and adjacent to this State (Vicksburg, Meridian, Memphis, Mobile), from the volunteer observer at Helena, Ark., and from cotton region observers in this State when obtainable. The latter reports are regularly received during the crop season, and some of the cotton region observers (a varying number) act as volunteers during the winter months, and forward direct reports during the summer. The monthly bulletin thus gives a summary based on an average of about 38 reports from well-distributed stations. It is believed to be a very fair exponent of temperature, rainfall, and other weather conditions in Mississippi; 185 copies of this bulletin are distributed to the press, to State services, to volunteer observers, and to others specially applying for them.

The material out of which these bulletins are being worked is gradually put into shape for publication as a whole, and it is hoped that the legislature of the State will next winter provide for its publication in this shape.

The weekly weather-crop bulletins of this office, begun about two years ago, have continued to grow steadily in interest; 180 copies are issued weekly, about half of these being furnished to the press in this and surrounding States. There are 59 reporters for this bulletin in the State. Interest in the work has been promoted by the issue of circulars from this office to parties over the State. The reports are mostly directly from planters, and are believed to give a fair indication of the effect of the weather on crops.

Defective postal facilities interfere with the promptness of this service.

It is respectfully suggested that it is important enough to warrant the expense that would allow the use of the telegraph in transmitting weekly reports to the central office from distant reporters in the State.

A number of the volunteer observers of the State have been induced to coöperate with Mr. Mally, the agent of the U. S. Entomological Bureau at Shreveport, in the study of the habits of the cotton boll-worm.

This service has been instrumental in creating a popular interest in Mississippi in the forecasts of the national Service, particularly in frost warnings. These latter have been of very considerable value to the growers of early vegetables in the southern parts of the State. Parties engaged in these interests now attend to the warnings of the national Service frequently in a manner unthought of three years ago.

There are many towns in this State reached by local telegraph or telephone lines, and which can not, under existing rules, be supplied with forecasts at Government expense. When the local lines offer to serve these communities gratis the service is imperfect. Many communities would be profited if the forecasts could be sent regularly over the local lines.

The work of revising and consolidating reports and issuing bulletins has grown to be quite large.

It is confidently believed that the legislature will provide for publishing a memoir on the weather and climate of Mississippi if the compilation of the data available can be provided for.

MISSOURI.

[Central office, Columbia; Mr. Levi Chubbuck, director; A. L. McRae, assistant to the director.]

Report of the working of the Missouri State weather service for the year ending June 30, 1891:

The meteorological department of the Missouri State board of agriculture has been continued throughout the year on the same general plan that was outlined in last report.

The State legislature which met this year, recognizing the importance of the work done by the board of agriculture for the benefit of the people of the State, increased the biennial appropriation for the maintenance of the board from $7,200 to $24,000, including in this latter sum $1,000 a year for a State weather service. This appropriation has not been available long enough at present to have effected much change in the condition of the service, but it will enable us to make great improvements in the equipment of the service as well as in the facilities for carrying on the work.

Prof. Francis E. Nipher, of Washington University, St. Louis, who organized and conducted the Missouri State weather service for thirteen years, has turned over his weather service to the board of agriculture, which now looks after both the climatology of the State and weather crop conditions.

All the available rainfall data for the State was published in the annual report of the board of agriculture for 1890, and all of the temperature and miscellaneous data, including ground temperatures at Centerville, have been published in the annual report for 1891. The number of voluntary observers has increased from 65 to 85, and plans are being carried out to increase this number to 150.

The weather forecasts have been displayed at about forty stations in the State during the year and have given general satisfaction.

The weekly weather crop bulletin has proved of the greatest value to the people of the State. The appreciation of its value and importance is daily increasing. It is now used by 237 weekly newspapers, and by 15 general agricultural newspapers of the country, and is telegraphed by the Associated Press to the daily papers. It is also mailed to many individuals and business firms in the State and country. This service has printed its weekly weather crop bulletin since the first of the present season, and has about completed arrangements by which temperature and rainfall charts upon a map of the State will be issued in connection with the weekly bulletin. After July 1 it is expected that facilities will be such that 1,000 copies of the bulletin and map can be issued each week.

The thanks of this service are due to the press of the State for the valuable assistance it has rendered in disseminating the information issued by the office; to the voluntary observers, and to the crop and weather reporters for the regularity and faithfulness with which they have performed their labors; and to the Chief Signal Officer for furnishing supplies, for the loan of necessary instruments and for his hearty coöperation and assistance in the work of this service.

NEBRASKA.

[Central office, Crete; Prof. Goodwin D. Swezey, director; G. A. Loveland, assistant to the director.]

The "Nebraska Volunteer Weather Service" was organized in January, 1878, under the direction of Messrs. Gilbert E. Bailey and Wayland Bailey. At the outset monthly and quarterly reports were issued by duplicating process. In the same year, or the next, Prof. S. R. Thompson of the State University at Lincoln assumed direction. Beginning with June, 1879, the monthly and annual bulletins were printed.

In August 1884, the present director, Prof. G. D. Swezey, assumed charge, and Boswell Observatory of Doane College, at Crete, was made the central office. At this time there were 45 stations, nearly all in the southeastern quarter of the State. To begin with, the reports, from the beginning of the service, most of them made by untrained observers, were overhauled and revised, many discarded as untrustworthy, and the remainder tabulated and averaged to serve as a foundation of a reliable knowledge of the progress of weather changes in the State. Beginning with January, 1887, a monthly precipitation chart, in colors, was issued by duplicating process to accompany the monthly bulletins. Beginning with April, 1891, engraved maps have taken the place of those by duplicating process.

During the early years of the service there was little or no increase in the number of stations, which remained at about forty. During the last five years the service has had the valued assistance of a member of the Signal Corps detailed by the Chief Signal Officer to assist the director of the State weather service. This, together with the liberal policy of the Signal Office in furnishing thermometers and rain-gauges during the last three years for distribution to observers, has made it possible to secure additional observers and so to extend the service. Especial efforts have been directed towards a better covering of the newer parts of the State with observers; of the six nearly equal sections into which the State is divided, no one has less than six stations of the seventy-three now reporting.

Until the present year no assistance has been received, either from the State or from any organization in the State, other than the college with which the central office is connected. At its last annual meeting the State Board of Agriculture made the director of the weather service one of its officers, "Meteorologist of the board," with a fund of $100 a year to defray some of the expenses of engraving and printing. This has made possible the proper illustration of the reports by engraved weather maps, and a wide distribution of them as published in the Annual Report of the State Board of Agriculture, and also in pamphlet form. The monthly and annual bulletins have also been published in full by the Nebraska State Journal, one of the leading dailies of the State, and extracts from these bulletins have been published by many other papers.

During the present year the weekly weather crop bulletin has, for the first time, been printed, instead of issued by duplicating process. This has made it possible to secure its better distribution and republication. It is now printed in most of the dailies and in many of the weeklies of the State.

This station has coöperated with the State experiment station in the study of the sugar-beet industry, which is making so large a promise in Nebraska. Besides the data furnished by the regular observers, those of the substations established for the purpose of making special experiments upon this industry have been compiled at the office and the results furnished to the director of the experiment station.

As to the degree to which the work has been appreciated by the people of the State, it is perhaps sufficient to refer to the large and increasing demand for monthly and weekly bulletins by the press of the State; to the official recognition of the service by the State Board of Agriculture; the interest manifested by the Burlington and Missouri River Railroad in Nebraska, which furnishes reports from ten of its stations, and the coöperation of the experiment station in the study of important industrial problems.

As to the work of the service during the fiscal year, there is little to add that has not already been set forth in the historical statement just made. The service has remained under the same management and with the same Signal Service assistant (Mr. G. A. Loveland) as for the past three years.

NEVADA.

[Central office, Carson City; Mr. Charles W. Friend, director; Ford A. Carpenter, assistant to the director.]

The following is the report of the Nevada State weather service for the year ending June 30, 1891:

On the fifteenth day of each month a weather review is issued, and this publication, in addition to the regular amount of meteorological data common to such reports, is accompanied by a chart and two weather maps. The chart represents, in graphic form, the average and monthly precipitation and temperature. The weather maps are similar to those issued by the general service; one containing rainfall data, the areas of precipitation being drawn over the face of the map, while the other map was devoted to the temperature and to the prevailing wind direction at each station. This monthly publication, presenting the weather conditions of the State, has been received with manifest interest by farmers, grazers, and others interested in the agricultural development of Nevada, and with the approval of the press and scientific men.

During the past year the following changes have been made in the detail of the assistants furnished by the Chief Signal Officer, and appointed in connection with the State weather-service work: Sergt. H. E. Wilkinson was relieved on the 26th of October, 1890, by Sergt. D. C. Grunow, who remained in charge until the 8th of June, 1891, when he was succeeded by Mr. Ford A. Carpenter, who is at present assistant director.

There are thirty voluntary observers who report to this office.

Too much praise can not be accorded these willing helpers who give their enthusiastic attention to the work.

This service is now on well-known and established foundations, and is sure to keep step with if not in advance of the rapid progress of the State.

NEW ENGLAND.

[Central office, Cambridge, Mass.; Prof. W. M. Davis, director; J. Warren Smith, assistant to the director.]

The New England Meteorological Society was formed in 1884 with the object of collecting meteorological data for New England, and serving such purposes as are filled by the state weather services, then established in various States, as well as to advance the interests of meteorological science. The first monthly bulletin was issued by the council in November, 1884, with 45 observers. The number rapidly increased until 140 reports were received in February, 1886; since then the number has maintained a nearly constant value. In the early part of 1885 the work of distributing weather signals in different parts of New England was undertaken, and at this time Gen. W. B. Hazen, Chief Signal Officer, detailed Private O. N. Oswell to aid the director of the society in its correspondence and tabulations. Mr. Oswell was relieved on October 1, 1888, being succeeded by Sergt. Park Morrill. Mr. Morrill was relieved on March 6, 1889, to attend the Paris Exposition, and until May 22, 1889, the work was in charge of Sergt. J. W. Smith, observer Boston Signal Office. He was relieved by Sergt. L. G. Schultz, who remained with the society until February 28, 1890, when he resigned, and again Sergt. J. W. Smith was temporarily in charge. He was succeeded on April 18, 1890, by Private J. Warren Smith, who is still with the society.

Prof. W. H. Niles has been president of the society since its formation; Profs. Winslow Upton and W. M. Davis have alternated with each other in the offices of director and secretary. Other members of the council have been Desmond Fitzgerald, C. E.; E. B. Weston, C. E.; A. Lawrence Rotch; F. V. Pike. The membership in the society has numbered about ninety. Three regular meetings are held each year, at which subjects of meteorological interest are discussed; reports of most of these meetings have appeared in the American Meteorological Journal.

The society has been almost alone among the State weather services in undertaking original investigations of meteorological phenomena. The distribution of rainfall in cyclonic storms in New England; the occurrence of thunder-storms, and the action of the sea-breeze on the Massachusetts coast have been examined, and the results published.

The work for the past year has been in charge of the director, Prof. W. M. Davis, with private J. Warren Smith, Signal Corps, as assistant. The office of the society was moved last September into much more spacious and newer quarters in the new University Museum building. The work during the year has been much the same as in former years. Regular observations of the climatic elements have been continued, reports being received from about one hundred and forty-five observers, and the results published in the monthly bulletins. The advance sheet, giving a short history of the weather conditions, has been issued on the 4th of each month during the year, and mailed to about seventy-five newspapers. The list of stations remains about the same, few changes having been made. The Harvard College Observatory has taken up the work of furnishing instruments in desirable locations, and several new stations have thus been established near the end of the year.

The annual report and investigations of 1889 was published during the year, and that for 1890 is now nearly ready for the press. It will contain the reprint of the tables from the bulletins and a set of tables and review for the year. In the same volume there will appear an account of the Lawrence tornado of July 26, 1890, by H. F. Mills and H. H. Clayton; an essay on the Cylonic Phenomena in New England by Prof. Winslow Upton, of Browns University, and a five-year normal table of all temperature and precipitation records in New England by J. Warren Smith. This table will contain over three hundred temperature and precipitation pentads, and will include many records taken before the year 1800. This table has been made much more complete through the kindness of the Chief Signal Officer, who has sent copies of a good many old records. Much time and care has been taken to make the table as complete and accurate as possible, and it is hoped that it will prove of interest to the science of meteorology. The work at present in hand in the office of the society is, first, the preparation of the monthly bulletin; second, the issuing of the weekly crop report; third, the preparation of the annual report and investigations; fourth, the reduction of the thunder-storm observations made in 1886 and 1887, which was discontinued last fall to take up the work on the pentad table. All the above work is performed by the assistant under the advice of the director. About twelve days each month are given to the bulletin, including in this preparation from the observers' reports, proof-reading and mailing; the crop reports and bulletins consume a little more than one day each week, reports being received from one hundred and eighty-six observers. A double-sheet bulletin is issued every Saturday and mailed to exchanges, observers, newspapers, granges, etc. About seventy-five papers have expressed a desire for these bulletins in New England and New York, and they either print the bulletins in full or extracts from them. The balance of the month is given to the original work of the society.

The number of weather signal display stations has varied somewhat during the year, but at the end of the year there are twenty-two stations receiving the forecasts, including the regular Signal Service stations, besides several that have been discontinued during the summer. In their reports to this office they give a high percentage of verification and express general satisfaction with the results.

NEW JERSEY.

[Central office, New Brunswick; E. W. McGann, director.]

The New Jersey State Weather Service was reorganized under State patronage for the first time on October 27, 1890, in accordance with bill passed by the legislature and approved by the Governor on June 19, the full text of which was published in the last annual report. The following is the personnel of the board of directors: James Neilson, esq., director of the New Jersey State Experiment station, president; E. B. Vorhees, professor of agriculture, treasurer; Byron D. Halstead, professor of botany and horticulture, and E. W. McGann, secretary and director.

At the first meeting of the board, held on October 27, 1890, the observer was authorized to purchase from Queen & Co., of Philadelphia, 22 sets of instruments (maximum and minimum thermometers), 22 rain gauges, and 25 measuring sticks, as provided for in the act, and to personally select such voluntary observers throughout the State as deemed expedient for the success of the organization. In accordance with these instructions the instruments were procured and by May 1, 1891, the following stations were established and the observers personally instructed in the management of the instruments, reading and recording the observations, etc.: Blairstown, Belvidere, Camden, Dover, Franklinville, Hightstown, Lancewood, Mount Holly, Newton, Paterson, Pochunk Mountain, Salem, Somerville, and Vineland. In addition to the above the following stations have been furnished with instruments to replace those other than standard: Lambertville, Tenafly, Imlaystown, Bridgeton, Billingsport, Moorestown, Madison, and Cape May.

At the close of the last annual report there were 39 stations regularly communicating with this office. During the year 5 were discontinued, mostly owing to the failure on the part of the observer to furnish reports. There are at present 46 stations; of these 4 are equipped by the U. S. Signal Office, 14 are furnished at the personal expense of observers, and the remainder have been supplied by the central office. This gives a net gain over last year of 7, and an actual reinforcement of 11.

Each of the above observers furnish this office with the original copy of observations made during the month of which it is a record. These reports are carefully examined, summarized, and published as a monthly bulletin of the New Jersey State Weather Service.

The meteorological data furnished by the service during the year have already proved of much value to the State geological survey. The chief engineer declares that the data furnished at his request (monthly mean temperature and daily precipitation at selected stations for the years 1889 and 1890) were invaluable in completing the record desired of the rise and flow of streams and their consequent power for supplying the cities of the State with water for domestic and manufacturing purposes.

The most noticeable feature of the work during the year, and one which has been most appreciated by the farmers of the State, is the weekly weather-crop bulletin, which has been issued regularly from the central office every Saturday during the growing season. These bulletins contain reliable reports from observers (mostly farmers) in nearly all the agricultural districts of the State, giving the prevailing weather conditions of the week and their effect on the growing crops. The issue began with 300 copies, but the demand was so great that it rapidly increased to 1,000, and this number was inadequate to supply the almost daily requests for copies of this bulletin.

These bulletins were published by nearly all the leading daily and weekly newspapers of the State, and by the great dailies of New York and Philadelphia. Copies were also furnished, by request, to boards of trade in some of the most prominent cities of the Union and in the British provinces. The benefits to the farmers of our State resulting from the wide publicity of crop reports can not be measured by dollars and cents. It is now impossible for the sharp speculator to misrepresent successfully the actual crop situation in order to depress, temporarily, the prices until he can obtain possession of larger portions of salable crops.

At the request of the Secretary of the New Jersey Cranberry Growers' Association the following points were selected to receive frost warnings in the interest of the cranberry growers of the State: Haddonfield, Kirkwood, Berlin, Atco, Winslow, Hammonton, Elwood, Pomona, Absecon, Egg Harbor City, Waterford, New Lisbon, Pemberton, Trenton, Atsion, Winslow Junction, Hornerstown, New Egypt, Vincentown, Jamesburg, Tom's River, Shamong, Lakewood, Millville, Vineland, Medford, Tuckahoe, and Farmingdale.

With the coöperation of the National Service (which furnishes by telegraph, free of expense, the daily weather indications, frost warnings, and cold-wave signals) these stations have been established: Bridgeton, Egg Harbor City, New Brunswick, Orange, Plainfield, Rahway, Trenton, Englewood, Madison, Westfield, Cape May Point, Long Branch, Palmyra, Newton, Camden, and Somerville.

NEW YORK.

[Central office, Ithaca; Prof. E. A. Fuertes, director; R. M. Hardinge, assistant to the director.]

Résumé of the operations of the New York Meteorological Bureau during the past fiscal year, and also a brief account of its establishment and previous work.

During the year 1888 the present director, not being able to obtain an appropriation from the State to meet the expenses of a weather service, decided to start a provisional organization, and accordingly, in September, 1888, meteorological reports were collected at the central office from such observers as had been supplied with instruments by the Chief Signal Officer, or by private purchase. During the same month Mr. I. W. Brewer, of the Signal Corps, was detailed to serve by the Chief Signal Officer.

The number of voluntary observers in the State reporting upon temperature and rainfall has been increased during the existence of the service from 20 in September, 1888, to 75 in June, 1891. In addition to this number, reports are received from 6 Signal-Service stations within the State, and, through the courtesy of the Surgeon-General, from 12 military posts. These, with 32 special rainfall stations, make a total of 111 meteorological stations reporting to the central office. Only 7 stations have been discontinued during the existence of the service.

The number of display stations receiving the daily telegraphic forecasts from Washington is now 37; but this number by no means represents all the stations displaying forecasts. Many displaymen obtain their indications from the Associated Press dispatches, or from the daily weather maps issued from New York City and Buffalo.

In addition to the regular work involved in the publication of meteorological and crop reports, this office has undertaken a thorough investigation and reduction of all the available data upon the meteorology of New York, especially with a view to the determination of temperature and precipitation normals. A reduction of the data obtained from 10 thermographs now located in various portions of the State will be undertaken as soon as the year's records are complete.

The meteorological and crop reports of the Bureau have met with a very favorable reception by the general public, and also by the press of the State, which very frequently has published copious extracts from the reports. This office also has frequent requests for special information from the State engineer, the canal department, city water boards, city boards of health, engineers, commission merchants, farmers, and physicians. The data obtained by the service is also often used as evidence in legal cases.

The director has received the effective assistance of Messrs. I. W. Brewer, I. G. Gardiner, and R. M. Hardinge, who have been successively detailed to the service since its organization. The commissioners desire to acknowledge their indebtedness to the national Service for the valuable aid rendered in this and in many other directions.

On the 15th of October, 1888, the first meteorological summary of the service was published, the data being furnished by twenty voluntary observers and 26 display stations. During the following winter and spring 15 new stations were established, the equipment being kindly furnished by the national Service, excepting in a few cases where standard instruments were not used. On March 23, 1889, the first crop bulletin of the service was published, by cyclostyle process, embodying information furnished by twenty-six correspondents, representing 12 counties. This publication at once met with general favor and received a wide publicity through the press of the State.

On April 15, 1889, the State legislature passed an act establishing a State Meteorological Bureau and Weather Service. The commission, organized in June of that year, and still holding office, is as follows: President, Hon. A. S. Draper; director, Prof. E. A. Fuertes; treasurer, Hon. Simeon Smith. During the summer and fall instruments were purchased and tested, and new stations were established as rapidly as observers could be found in the proper localities. During the spring and summer of 1890, forty special rainfall stations also were established, and, in addition to these, nine stations were equipped with thermographs, mainly for the purpose of making a detailed comparison of the temperature conditions upon the hill summits and in the adjacent valleys.

NORTH CAROLINA.

[Central office, Raleigh; Dr. H. B. Battle, director; C. F. von Herrmann, assistant to the director.]

The following is the annual report of the operations of the North Carolina State weather service for the year ending June 30, 1891:

During the past year the State weather service has continued its work on substantially the same plan as indicated in preceding reports. The more practical part of the work is the distribution of the weather and temperature forecasts to various points in the State. Until the 1st of December, Charlotte continued to be the center for distributing these telegrams, but, believing that greater promptness could be secured if the work were under the immediate control of the director, the distributing center was transferred on December 1, 1890, to the central office at Raleigh. At the end of the year forecasts were being telegraphed to twenty-six places. It is evident that the number of display stations is too small to cover the large area of the State, and that the mass of the people, especially farmers, do not derive as much benefit from the forecasts as might be possible with a better system of distributing them. Prof. Francis E. Nipher has called attention to the fact in a recent paper on the State weather service, read in Jefferson City, Mo., in January, 1891, and has expressed the opinion that when the present broad patents on the telephone expire, the effect will be to decrease telephone rates in small cities so that farmers can afford to use them. Forecasts could then be widely distributed by telephone.

In order to secure the best results in connection with such a system, the director at the central office of the local weather service should be authorized to issue forecasts for his State only, and it is probable that thus a higher degree of accuracy can ultimately be attained. At present forecasts are telegraphed to stations where they are displayed by a system of flags, which is simple enough and easily understood. The cost of flags, however, deters many from applying for the forecasts. As the State weather service is an entirely voluntary organization, and at present receives no support from the State, flags can not be furnished.

The weekly weather crop bulletin of this service was issued during the year 1890 from April to October, and was resumed again on April 24, 1891. More than seven hundred copies are required to supply the demand. The extent of distribution may be inferred from the fact that copies are sent to the Cotton Exchange, New York, New Orleans, Shreveport, La.; the Board of Trade, Memphis, Tenn., to every paper in the State, to all correspondents, and to many others. During the present season the list of crop correspondents will be greatly increased. It is desired to have a reporter at every post-office receiving a daily mail in the State. At present writing the number of correspondents is 200.

The crop season in 1890 was one of the most productive in many years. The yield of cotton and tobacco especially—the staple crops of the State—was unusually large. This was in great part due to the very early beginning made by farmers in preparing the land and sowing the seed, owing to the mild winter preceding, and to the very slight damage done by insects during the year. The yield of fruit, however, owing to the severe frost in March, after the mild winter had prematurely developed the buds of fruit trees, was much below the average. The season of 1891 began very unfavorably. Too much rain, lack of sunshine, and deficiency of temperature have combined to put farm work in many places weeks behindhand. Cotton will hardly yield an average crop even with a late and very favorable fall. The prospect for fruit is much better.

Reports have been utilized during the year from forty-six meteorological stations, which includes ten Signal Service and ten cotton region and rainfall stations. The reports, embracing barometer readings, temperature, rainfall, humidity, direction of the wind, state of the weather, and miscellaneous phenomena, are tabulated each month, and published as bulletins of the North Carolina agricultural experiment station. The series of bulletins for the year

1890 contain a complete record of the various elements of climate for that period. Each monthly bulletin contains a brief summary of the weather during the month; tabulated data, including tables of maximum and minimum temperatures; daily mean temperatures; rainfall; tables of comparative data for previous years; also miscellaneous notes furnished by individual observers, concerning various phenomena. The tables of comparative data published in the bulletins for 1891, include climatic features for the past ten years. Occasionally articles of more general interest are published. Bulletins are sent to any one making application for them. Copies are furnished to the observers of the service, to many newspapers, and to other weather services in exchange. An annual report is also printed giving a résumé of the observations taken at all stations during the year.

An attempt was made during the year to increase the number of meteorological stations. A special letter was sent to many teachers in the State inviting their attention to the subject of meteorology as a means of training pupils to habits of exact observation of the natural phenomena which are constantly occurring, and which should be systematically recorded in order that an accurate knowledge may be obtained of the data from which are deduced the laws governing climatic changes. Several replies were received and a number of gentlemen have been supplied with standard instruments, loaned by the signal office, and are now reporting regularly to the central office.

Many observers have continued their observations with great regularity throughout the entire year. There is no higher mark of patriotism than the willingness to devote part of one's time and labor to the service of the State, without expectation of any recompense. It is to be hoped that the State will ultimately appreciate their services to the extent at least of appropriating sufficient funds to furnish voluntary observers with the necessary instruments, for which they should be put to no expense whatever.

Sergt. C. F. von Herrmann, Signal Corps, has continued as assistant to the director during the past year. The director desires to express his appreciation of Mr. von Herrmann's active and energetic interest in all matters pertaining to the weather service.

The earliest attempt to keep a systematic record of climatic data throughout the State of North Carolina was made by Prof. W. C. Kerr, State geologist.

In reply to the circular letter of April 11, 1881, issued by the Chief Signal Officer, Prof. Kerr, under date of April 29, 1881, wrote as follows:

"By reference to the 'Geology of North Carolina,' 1875, Vol. I, p. 70, you will see a list of the stations, 32 in number, where observations have been secured. I am now publishing Vol. II, in which I shall have about 40 stations. This office has for ten years furnished blanks, instruments, envelopes, postage, and instructions to observers, whenever they could be obtained, and in a few cases has paid a small sum, $1 or $2 a month. But not half the persons furnished with appliances continued to make observations more than a few weeks or months. I furnished a rain gauge and thermometer with blanks, and about a dozen with hygrometers, Winlock's hydrophant.

"Now I shall be glad of any assistance or suggestions looking to a more complete and effective service. The governor will use his influence to aid in securing observations at several public institutions soon to be completed; but it seems impossible to secure observations in many counties, and even whole regions, without some additional inducements."

The records for the second volume of Prof. Kerr's Geology, above referred to, were never published, nor have the observations which continued to be taken at many places after 1875 been tabulated. Many of these records have but recently come into possession of the State weather service, and will be prepared for publication as soon as possible. The report in Prof. Kerr's first volume is quite complete, and, though based in many cases on insufficient data, is a valuable contribution to the climatology of North Carolina.

The offer of assistance and suggestions of the Chief Signal Officer, looking to a more complete service at that time, led to no result. After 1875 no further interest seems to have been taken in the continuation of the meteorological work, and observations were gradually discontinued at nearly all stations, until the matter was taken up by the North Carolina board of agriculture in 1886. At its July meeting in that year the board resolved, if facilities could be obtained, to establish a fully equipped weather station in connection with the experiment station. The commissioner of agriculture was instructed to lay the petition of the board for assistance before the Chief Signal Officer, who gave a prompt and favorable reply, promising to detail an experienced weather observer and to equip one full signal station. Subsequently, Dr. Charles W. Dabney, jr., director of the experiment station, organized the weather service as a separate division, and the Chief Signal Officer detailed a regular observer, Sergt. William O. Bailey, Signal Corps, as assistant. By the 1st of January, 1887, thirty-nine voluntary observers throughout the State were reporting to the central office at Raleigh. The reports were tabulated and printed each month in the bulletin of the State Department of Agriculture.

The North Carolina weather service continues to be an entirely voluntary organization under the control and at the expense of the experiment station. No money has been appropriated by the State for its support. The bulletins and reports, including the monthly meteorological bulletins, weekly weather crop bulletin, and annual report, are published separately in greatly improved form. Dr. H. B. Battle became director in September, 1887, under whose direction the weather service was materially improved, and fully organized as the meteorological division of the experiment station. Dr. Battle suggested the publication of the weekly weather crop bulletin in its present form, which was commenced in that year. During the past two years much greater interest has been taken in the success of the service by the public generally, and the benefits derived from it are more fully understood and appreciated. H. McP. Baldwin, Signal Corps, was detailed as assistant in 1887, and relieved in August, 1889, by Sergt. C. F. von Herrmann, Signal Corps, meteorologist.

The service has been developed with a view primarily to the interests of the farmer. It can not be denied that the state of the weather is a most important factor in farming. The success of failure of a crop is nearly always attributed to the favorable or unfavorable effect of the weather. Yet until recently it was hardly thought that the study of the subject would yield much of practical utility. That there has been a rapid development of the science of the weather during the past few years and a growing recognition of its importance to the farmer, is evident from the great interest taken everywhere in the State weather service.

The practical work of this service has been the dissemination of weather and temperature forecasts and cold wave and frost warnings. Although the system of displaying these warnings by means of flags does not completely satisfy the requirements, it is simple enough and easily understood. Space will permit of only one or two extracts from letters received to show the value and benefits derived from the forecasts.

Mayor W. E. Fountain, Tarboro: "The information conveyed by the weather forecasts is greatly appreciated at this point. On two occasions when the weather telegrams were temporarily discontinued by the service the expense of their continuance during the interim was borne privately. To what individuals or industries it is proving most useful can not be easily particularized, and varies with the season. Just now the harvesters, brickmakers, and builders are perhaps receiving the greatest benefits. The forecasts have become to many what a daily newspaper is, and their real value would only be discerned if continued."

Charles E. Johnson & Co., domestic and foreign cotton factors, Raleigh, N. C.: "We desire to state that the weather service has, in our opinion, come to be regarded as a necessity by our people, and the farming community which has access to the reports and forecasts have greatly benefited thereby. I have watched the weather forecasts with close attention, and they have been wonderfully accurate."

The weekly weather crop bulletin, issued by the service during the season of growing crops from April to October, has the greatest commendation. It is appreciated at home and abroad. It furnished well defined and accurate information regarding the weather and crop condition, which is promptly printed in all the papers. It makes outside misrepresentation of the crop conditions impossible. It places farmers on an equal footing with the dealers who purchase their products. It enables the farmers to judge whether they are receiving fair prices for what they have to sell.

The work of the service of more permanent value is the collection of meteorological data and its publication in tabular form. During the year 1890 a preliminary study of the principal climatic features of the State as a whole has been made, and tables of mean pressure, temperature, and rainfall, for the past nineteen years, were published in the annual report for 1890. The importance of this work may be judged from the fact that not even the annual mean temperature of the State has ever been determined with any approach to scientific accuracy. It has been variously given as 58.7°, 62.3°, and 57.4°, the true value being 59.7°. While knowledge of the climate of the State remains so uncertain as this the importance and value of the work of the weather service can hardly be overestimated.

The director begs permission to make the following suggestions to the Chief Signal Officer with a view to increasing the efficiency of the State weather service and of bringing home to the people of the State the value and importance of the work of the national service:

(1) That the director or his assistant be authorized to issue forecasts for the State of North Carolina and to telegraph the same to such places as shall be selected, at Government expense. The assistant, Mr. C. F. von Herrman, after an experience of over a year in making forecasts for Raleigh and vicinity, feels confident that he could make such forecasts with a considerable degree of accuracy. A long experince in forecasting for a definite region, a thorough knowledge of the topography and soil, as well as general peculiarities of climate, and a good memory for special types of weather over the State are indispensable to the official making the indications, and such knowledge can not be acquired by one who has to make forecasts for twenty or thirty different States in the Union.

(2) The issue of weather and temperature signal flags at Government expense is recommended.

(3) That some simple and inexpensive instrument shelter be devised for issuing to voluntary observers. A large number of thermometers are broken every year by voluntary observers, especially at stations newly established, because of ignorance of the size and proper kind of shelter to be used and of the proper way of fastening the instruments in it.

(4) A number of requests have been received from the principals of schools in different parts of the State for the loan of barometers and other instruments, besides those regularly issued to voluntary observers, for the purposes of instruction. Where it is well ascertained that the instruments are actually to be used for the purpose of instruction it is recommended that a limited number of barometers and anemometers be loaned to observers making special request therefor.

(5) That a supply of about 50 rain-gauges be sent to the observer in charge of the central office, who should be held responsible for them, these guages to be issued to crop correspondents, to enable them to furnish more accurate data regarding rainfall each week than they at present can give.

(6) That instruments for special research be loaned the central office, if possible, when requested. The meteorologist desires to undertake some investigation of the temperature of plants at different seasons of the year, which would require some electrical method of measuring temperature, by means of a delicate galvanometer, as Thompson's reflecting or the Deprez-d'Arsonval galvanometer.

(7) That the observer detailed as assistant to the State weather service be directed to inspect all the voluntary stations in the State at least once a year at the expense of the General Government. The inspection of all stations could be done at one time and without great cost.

OHIO.

[Prof. B. F. Thomas, director; C. M. Strong, secretary.]

During the past year the work of the Ohio meteorological bureau has been carried on upon the same general plan as in former years, but slight changes having been made in stations and observers. A few new rain-gauge stations have been established, and some have been supplied with maximum and minimum thermometers. We have been obliged, for lack of funds, to refuse several applications for full station locations.

As stated in former reports, telegraphic weather predictions and flag displays are not in as great demand here as in other States. The number of places receiving such reports is below the generous list sent by you, though we have taken pains to offer the privilege as publicly as possible. This is doubtless due in part to the circulation of morning papers containing the reports. The cold-wave prediction and signal are more frequently called for.

On the resignation of Lieut. C. E. Kilbourne, occasioned by the termination of his detail at the university, Sergt. C. M. Strong was chosen secretary of the bureau, and has discharged his duties with skill and to the full satisfaction of the board of directors. I wish gratefully to acknowledge your kind interest and generous aid in our work.

OREGON.

[Central office, Portland; Mr. H. E. Hayes, director; B. S. Pague, assistant director.]

The following is the report of the operations of the Oregon State weather service for the fiscal year ending June 30, 1891:

Mr. H. E. Hayes has continued the director of the service and Mr. B. S. Pague, U. S. Weather Bureau, the assistant director throughout the year.

The legislature, at its biennial session held in January and February, 1891, made an additional appropriation of $2,000 for the purchase of more instruments and to enlarge the scope of the work, there being only two dissenting voices to the appropriation.

The practically unanimous vote for the appropriation shows the high esteem in which the service is held and its popularity with the people.

In the sparsely settled sections of the State, embracing the country south of the Blue Mountains and east of the Cascades, considerable difficulty has been experienced in securing correspondents and voluntary observers, but the work of establishing new stations has been steadily prosecuted. During the month of May, 1891, a new supply of thermometers and rain-gauges was purchased from Green, of New York, and these are being sent out. The instruments purchased of Queen & Co., Philadelphia, in 1889, have generally proven to be unsatisfactory.

Soil observations have been most carefully made at Pendleton, by Mr. P. Zahner, and since his death, which is greatly lamented, his son, J. H. Zahner, has continued making them; they have also been made at the Oregon Experiment Station, located at Corvallis. These observations will finally result in much good to agriculturists. Observations of the evaporometer will be commenced on 1st proximo. Sunshine recorders are being prepared for distribution, and these records will prove of additional value to the data already collected.

Especial attention has been paid to the collection of precipitation and temperature data, statistics as to wheat and wool products.

The special bulletin on "Oregon crops of 1890," issued in December, 1890, has proven of general interest, and its data appears to be appreciated by the people.

The weekly crop weather reports are the most popular feature of the service, and attract the most attention; coming regularly every week they carry with them concise and accurate information touching the productions of every county of the State, which can be gained from no other source.

The biennial report of this service to the governor has been most highly commended on all sides. The "American Meteorological Journal" said it was the most complete report on the climate of Oregon yet issued. One thousand copies of the biennial report were issued, as also 2,000 copies of the special crop report. One hundred and sixty copies of the weekly crop weather bulletin are issued weekly. The newspapers, public bodies, and leading citizens all give the service hearty support.

While marked progress and advancement have been made during the past year, more could have been accomplished if the assistant director could have had as good assistance in his office during the first six months of the year as he has had during the last six months. For more and better work, that is, work in detail, the assistant director should be able to devote his entire time to the work of the State service.

The service and its work were especially commended in resolutions by the State Agricultural Society and by the Oregon State senate in February, 1891. The State Grange indorsed the service at its annual meeting held in May, 1891.

Extensive outlines have been made for future work, which can be accomplished by continued diligent and sincere efforts. The thanks of the service are due the Chief Signal Officer for his liberal policy pursued towards this service, and thanks are extended to the energetic and valuable voluntary observers, each and all of whom have contributed to the success of the service.

PENNSYLVANIA.

[Central office, Philadelphia; Mr. W P. Tatham, director; T. F. Townsend, assistant in charge.]

The following is an annual statement relative to the operations of the Pennsylvania State weather service during the present fiscal year, together with a brief review or history of the service from its organization to the present time:

As the Franklin Institute probably antedates all other institutions in the United States in the organization of State services for promoting the science of meteorology, a reference to its earlier services in this behalf may be of interest.

On March 4, 1837, the legislature of this State passed the following act: "The governor of this Commonwealth is hereby authorized to draw his warrant upon the State treasurer, on the 1st day of April next, in favor of the treasurer of the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, for the sum of $2,000, and for the further sum of $2,000 on the 1st day of April for each of the two years ensuing, for the purpose of promoting the improvement of meteorological science and the furnishing of each county of this Commonwealth with the necessary instruments for the observation of such atmospheric changes and phenomena as may be useful for the promotion of knowledge in the science of meteorology."

From an extract of the minutes of the meeting of the committee on meteorology of the Franklin Institute held January 22, 1838, the chairman reported a list of 53 persons in the several counties of the State who had accepted the charge of the meteorological instruments provided in accordance with the act of the legislature of 1837.

A series of observations and reports, very similar in character and form to those now reported by the present service, were made and published monthly for two years in the Journal of the Franklin Institute.

In addition to this work for the State of Pennsylvania and within it, a joint committee selected by the Franklin Institute and the American Philosophical Society consisted of—for the Franklin Institute, James P. Espy (chairman), Alexander Dallas Bache, Henry D. Rogers, Sears C. Walker, Paul B. Goddard, M. D. For the American Philosophical Society, Charles N. Bancker, Gouverneur Emerson, M. D., Alexander Dallas Bache.

Their reports were published in the Journal of the Franklin Institute (1) July, 1835, p. 4; (2) June, 1836, p. 386; (3) January, 1837, p. 17; (4) August, 1838, p. 161.

This committee established correspondence with about fifty scientific observers throughout the United States, who made continuous reports of the weather, particularly in seasons of violent changes and storms, and from data thus collected charts of fourteen great storms were published very similar to those issued by the United States Signal Service of this day.

From the same data a practical theory of storms was deduced, which with modifications guides the existing practice of weather forecasts.

In this work the joint committee was most ably assisted by its chairman, the celebrated meteorologist, James P. Espy, whose energy and enthusiasm knew no bounds, and whose researches and investigations have so largely advanced the science of meteorology, and rendered possible in these days of the magnetic telegraph the application of that science in a practical way for the benefit of all who are in any way affected by climatic changes and conditions, as is daily demonstrated by the Weather Bureau of the United States States Signal Service.

Subsequently Mr. Espy was employed by the Government of the United States as meteorologist. He made four reports. The first, in 1843, was made to the Surgeon-General. His fourth report was published in 1857.

The establishment of a National Weather Bureau by the Government, with all of the modern appliances for observing and recording data, and its corps of trained observers seemed for a time to meet all requirements, but new interests and demands arose with the advancement of the great work which had been undertaken, and experience demonstrated the fact that auxiliaries were necessary to assist the national Service in the collection of climatic data and the dissemination of the forecasts and warnings of the National Weather Bureau.

In order the better to provide for these auxiliary services, it was decided that State services, under competent local management, would best subserve the interests of all concerned.

In furtherance of this plan, in the autumn of 1886, fifty years after the establishment of the first State weather service, the Franklin Institute was asked to undertake the organization of another State service, and become an aid in a work of which it had been the pioneer.

Believing that they could assist the National Bureau in disseminating its reports, and that, in the collection of meteorological data, permanent climatic conditions could be so established that the accuracy of forecasts would be increased, the Institute entered heartily into the work, and appointed a committee to formulate a plan for a State service.

On December 15, 1886, this committee made their report, which was adopted. Pursuant to its instructions the committee prepared the draft of a bill which was introduced into the legislature of Pennsylvania "to establish a State weather service, and appropriate the sum of $3,000 for the purchase of instruments, flags, and other necessary equipments, designated and approved by the Franklin Institute."

This bill was enacted into law by the legislature at the session of 1887, and was approved by the governor May 13, 1887. An additional sum of $5,000 was appropriated in 1889 to continue the State weather service.

On March 11, 1887, Sergt. T. F. Townsend of the Signal Corps was ordered to report to the committee on meteorology for duty and was appointed assistant in charge, in which position he has remained ever since.

As soon as the first appropriation was available steps were taken to purchase standard instruments similar to those used by the United States Signal Service. These were distributed to the various observers selected in the different counties. To facilitate the accurate recording of observations by men untrained for the work a special record book was adopted, which is still used by the service.

The first tabulated report published in the Monthly Weather Review was for the month of September, 1887, since which time they have been continuous and include reports from about 60 stations. These reports have an issue of 1,000 monthly, in addition to their being published in full in each number of the Journal of the Franklin Institute, which has an influential circulation. The secretary of internal affairs of Pennsylvania has also published the reports in full for the preceding twelve months in his annual report of each year. These publications give the review a large and widespread circulation and permanent record.

The June Review of 1889 contained a map graphically illustrating the unprecedented rainfall of May 30 and 31, which caused the disastrous floods at Johnstown and other portions of the State. Since then each issue of the Review has been supplemented by maps showing the normal temperature and rainfall for each month of the year and the mean temperature and rainfall for each current month, for the purpose of comparison.

After the reports of the observers are examined, tabulated, and published they are carefully filed away for future reference as occasion may require.

The weekly weather crop bulletins have advanced steadily in value and are now one of the prominent features of the service; 200 copies are issued weekly. It was intended to print the issue during the present season, but a combination of circumstances prevented.

About 60 display stations have been maintained, most of which are supplied with flags by the State service. While the State of Pennsylvania is well supplied with mail facilities, so that many farmers and others interested in the forecasts as published by the daily papers can receive them at an early hour, there are many beyond the reach of these means or the railway bulletin service, and can only be reached by some system of signaling. While the State service has done much to cover these grounds, the field is still a large one, and every effort should be made in the future to increase the number of display stations and to devise means for reaching as many as possible with the daily forecasts of the service.

Since the organization of the present State service special efforts have been made to collect manuscript and other copies of recorded meteorological data relating to this State. This resulted in securing extended records from about 50 stations, aggregating 950 years of observation. Through the valuable assistance of Prof. Lorin Blodget these records were systematically arranged and published by the secretary of internal affairs in a convenient form for reference.

The labors of these pioneer observers are not only preserved from probable loss, but they are now widely distributed throughout the State, and due credit has been given to these early investigators. The value of such a series can not be estimated in determining averages for the State or for establishing permanent climatic conditions for the localities they represent.

The secretary of internal affairs, in his annual report of 1891, suggested that the legislature should either give entire control of the management of the funds and property of the State weather service to the Franklin Institute or confer the entire authority upon the secretary of internal affairs.

In ignorance of this suggestion by the secretary a bill was prepared and introduced in the House of Representatives appropriating $5,000 for continuing the State weather service under existing laws. This bill was amended in committee so as to embody the suggestion of the secretary.

In this shape it passed both houses, and since then has been vetoed by the governor, as would appear from the following notice published in the newspapers:

"Proposed transfer of the weather service. I herewith file with my objections, in the office of the secretary of the Commonwealth, house bill No. 740, entitled; 'An act to amend an act to establish a State weather service of this Commonwealth for the purpose of increasing the efficiency of the United States Signal Service, by disseminating more speedily and thoroughly the weather forecasts, storm and frost warnings for the benefit of the citizens of the State, and for the purpose of establishing and maintaining in each county thereof meteorological stations for the collection of climatic data, and making an appropriation therefor; transferring to the department of internal affairs the duties pertaining to the State weather service heretofore discharged by the Franklin Institute, and providing a further appropriation for the maintenance of said weather service.' This act proposes to take from the Franklin Institute the right of exercising certain duties pertaining to the State weather service, which it has heretofore discharged, and to make them subject to the direction and control of the department of internal affairs. I know of no reason why duties of this kind, which can be best performed by scientific experts, should be transferred from an institute of such long and honorable standing as the one in which they were reposed by the act of 1887, and transferred to the control of a department which is neither especially adapted for the purpose for which it is instituted nor by its equipment and organization. The terms of the act of May 13, 1887, accepted a plan proposed by the Franklin Institute, and if it has proved practicable and useful the subject should not be taken out of its control.

"If it has proved impracticable and of no utility, it is not likely to be made more efficient by the proposed transfer. The increase of the appropriation for this purpose does not indicate that the change will be advantageous to public interest."

The foregoing is an outline of the history of the Pennsylvania State weather service and of the connection of the Franklin Institute therewith.

It is to be regretted that the appropriation for establishing the State weather service, made in 1887, was so small. A large portion of it was expended for instruments, and the money was exhausted before the appropriation of 1889 was available to continue the service. The appropriation in 1889 of $5,000 supplied the deficiency and continued the service. It was hoped that the appropriation of a similar amount this year would have enabled the committee to provide an efficient display service for disseminating the reports and forecasts of the United States Weather Bureau throughout the State during the coming two years, but for the present this thought must be abandoned.

The Franklin Institute has no fund which can be drawn upon for the expenses of printing the monthly weather reviews. At present we can only state our willingness to continue to record the observations and hope that the body of intelligent observers throughout the State, who have manifested a zeal for the public service which can not be sufficiently commended, may continue to give us their coöperation.

If observations are continued, and records preserved, some means may be found hereafter to continue the publication.

SOUTH CAROLINA.

[Central office, Columbia; Mr. A. P. Butler, director.]

The annual report of the State weather service of South Carolina, coöperating with the United States Signal Service for the year ended June 30, is as follows:

This service was organized in August, 1886, and up to September 16 last was under the supervision of Mr. A. P. Bulter, as director, conducted by an assistant who was an enlisted member of the United States Signal Corps. On September 16, 1890, the observer on duty was transferred to New Orleans, and his duties, in addition to his own, were devolved upon the director. The work had been so thoroughly systematized and so well organized that it has been comparatively easy to continue it in successful operation. This has been made possible by the assistance cheerfully rendered by the corps of intelligent voluntary local observers, who served without compensation.

At this station the daily weather forecasts are received and signal flags displayed; the daily temperature and rainfall is recorded and tabulated monthly. On Saturday of each week a crop report is published, compiled from information furnished by voluntary and cotton-region observers, and these are sought for and published in all the daily papers. A synopsis of reports is telegraphed to the Chief Signal Officer, and used in the weekly crop report sent out from the central office.

The weather forecasts received from Washington are wired to the fifteen stations in the State in charge of observers who display the signals showing the indications for the day. Reports are received at the end of each month from twenty-two observation stations (two recently established, Kitchings Mills and Society Hill), giving the rainfall and temperature for each month. These are tabulated and recorded and a copy sent to Washington.

The cold-wave warnings are received from the Chief Signal Officer and duplicated to all display stations.

The value of the weather service is appreciated each year as it is better understood by the people. The collecting and recording of climatic data in South Carolina has been needed for many years. Outside of a few cities this had never been attempted until the establishment of a weather service in South Carolina. There are now nearly five years of a very perfect record, and this will be of great future benefit in many practical ways.

The truck and fruit interest of this State is each year being of greater importance. The cold-wave warnings enable the producers to take the necessary precautions for the protection of these crops, and this part of the service has proven specially popular.

The attention given to the service in recording temperature and rainfall, the display of signals, and the information regarding the condition of the crops furnished weekly, by citizens who derive no immediate paying benefit from such work, and which require no considerable labor, and the interest of the State, and people generally in the work of the service, all indicate clearly the favor with which the important work of the Signal Service is regarded in this State. As this work expands its usefulness is increased, and in the same ratio is it appreciated.

SOUTH DAKOTA.

[Central office, Huron; S. W. Glenn, director.]

The following is a review relative to the North and South Dakota State weather service since its organization, and for the fiscal year just ended.

The matter of organizing a local weather service was brought to the attention of the observer in charge at the central office by Lieut. H. H. C. Dunwoody, in December, 1888, and the usual aid extended to similar organizations in the States was tendered to Dakota.

The observer brought the matter before the people in several ways, but especially through the "press." A strong interest was soon aroused, and it was not long until a sufficient number of stations had been established, and reports rendered to warrant the issue of a monthly summary and review.

As the crop season of 1889 approached the proposed issue of a weekly weather-crop bulletin was brought before the people, and reporters for this publication were secured in almost all of the counties in the then Territory of Dakota.

The issue of the monthly summaries has been regular and uninterrupted, and between March 15 and September 15 of each year a weekly weather-crop bulletin has been issued.

After the south half was admitted as a State, an effort was made to place the service on a firm basis as a State institution, receiving material aid therefrom. With this result in view the matter was agitated, and the cause of the service espoused by prominent men. A bill known as Senate bill No. 148 was introduced in the first session of the legislature of South Dakota, and pressed to passage, establishing the South Dakota meteorological bureau, and empowering the Governor to appoint a director from the faculty of the State Agricultural College at Brookings. A provision for a small appropriation was stricken out in joint committee, because, it was said, of urgent economy and the fact that the Signal Service was already publishing and issuing the reports in a satisfactory manner. The observer is well satisfied that the failure of the appropriation was not due to lack of appreciation of the service by the people.

During the year just ended, and since its organization, the service has been conducted wholly by the observer in charge at the central office, and the Governor has failed to appoint a director for the reasons above stated. The matter of an appropriation from the second session of the legislature was not pressed because a careful canvass gave no promise of success.

The summaries and reviews have been continued during the year, as also the weekly weather-crop bulletins. The publications of this service find their way to all parts of the United States. The crop bulletins are an important feature of the work, and appear to fully meet the demands of the people in that special line. As an evidence of their appreciation by people both in and out of the State it is noted that those who received them during the former seasons, and many who had heard of them or seen them in the papers, made requests to be listed before the present season had begun. They are published by all of the papers issued at Huron, two dailies issued at Sioux Falls, S. Dak., and a number of weekly papers throughout the State; also by two dailies in St. Paul, two in Minneapolis, one in Sioux City, Iowa, and three in Chicago. The local correspondent for the papers outside of the State is authorized to wire them regularly.

A few places in both States receive the daily forecasts from Washington, and more would be glad to have them were it not for the considerable expense attending the display of the weather and temperature signals. The flags wear out rapidly, and are soon in unreadable condition, except in their immediate vicinity. If some more durable signal could be devised to serve the same purpose at less expense, it is believed all considerable points would appreciate the forecasts and lend their coöperation in every manner possible to carry out the intentions of the Department at Washington. "Cold-wave warnings" to prominent points, in fact in all considerable towns where the expense of a flag would be borne by the people, would be of great value. This would involve only small expense to the people, and the cost to the Government of an occasional telegram. The signal would attract special attention by the infrequency of its display, and the high percentage of verification attained would establish a confidence and reliance in the display. With one signal alone displayed, its character would be understood at long distances in the adjoining country.

As the forecasts under the flag system appear to benefit only the people in their immediate vicinity it is believed they would meet the demands of the public if a neat frame (one or more), was furnished to each place receiving them, with the explicit understanding and agreement that the postmaster should regularly display the telegrams for the benefit of the public.

It is believed warnings to prominent points, in both States, of approaching blizzards or storms with snow and strong northerly winds would be highly appreciated by the people, mayhap result in the saving to them of property, and possibly life. Such timely warning before the memorable blizzard of January, 1888, would probably have saved many lives.

The observer at the central office has frequently had occasion in the winter to give information, on request, as to the advisability of persons making contemplated overland journeys, or returning to their homes in the country, and, taking the testimony of the people into consideration, has probably saved them much suffering, and possibly life. This was before the publication of a daily map, the advantage of which is now enjoyed, and the further privilege of making unqualified local forecasts. The voluntary observers serving in connection with the local service have evinced great interest and deserve unstinted commendation for their faithfulness.

The interest in the meteorological work has grown so that stations are now established in all but twelve of the thickly settled counties of South Dakota, and correspondence is now being had with most of these, which will probably result in stations being established within their borders. Through the instrumentality of Dr. H. E. Stockbridge of the North Dakota experimental station at Fargo, twelve additional stations have recently been established in that State.

The local service is steadily growing in favor with and importance to the people of South Dakota, and their appreciation is evinced in many ways.

The need of a full assistant, capable of taking the place of the observer when otherwise engaged on duty or legally absent from duty, especially as this station has been made one of the first order with the attendant additional clerical work, is greatly felt. The small amount allowed for a messenger precludes the employment of any one in other than that capacity, and his duties are confined to such service.

Huron is centrally located and frequent conventions of the people are held here. In most of these gatherings there are more or less of the gentlemen coöperating with or interested in the success of the service. The services of the former and the moral support of the latter entitle them to the utmost courtesy consistent with proper attention to duty when visiting the central office. Uniform courtesy to visitors has done much to popularize the office and the local service, but it entails upon the observer constant duty on Sundays and holidays and continued duty every day of the week, comprising hours outside of those usually expected. The matter of rainfall is of vital importance to the people, and knowing that this office is constantly in receipt of such information they come here for it.

TENNESSEE.

[Central office, Nashville; Dr. J. D. Plunkett, director; H. C. Bate, assistant to the director.]

The following is the report of the meteorological department of the Tennessee State Board of Health, for the year ending June 30, 1891:

Mr. J. D. Plunkett is director of this board, and Sergt. H. C. Bate in charge of the Nashville signal office, assistant director.

While the number of voluntary stations in Tennessee remains substantially the same as during 1890, there has been a very satisfactory improvement in the service during the past year, and at this time it is in a much better condition of efficiency than at any previous time in its history. This is due, in a great measure, to the faithful work of the corps of voluntary observers who have shown an increased interest in their work, and who evidently make the most of their limited facilities in the collection of local meteorological data.

The lack of a supply of standard instruments, especially thermometers, has been, and continues to be, a serious obstacle in the way of increasing the number of observers in the State, as well as the efficiency and value of the observations taken. The State Board of Health, with its small appropriation, though anxious to do so, could not supply this demand, except in a very limited way, and the National Service has done much, it is true, toward this end in the past, still there is much more urgently needed in this direction. More than once, recently, applications for service as voluntary observers have been declined for want of instruments.

With the exceptions of a few localities, the State is now pretty well covered by voluntary stations. The new stations that have been added during the year accomplished this purpose to a considerable extent, and most of them have already proved exceedingly valuable additions to the service; still, more are needed to cover the territory.

The publication of the weekly weather-crop bulletins was resumed in March, and the increasing interest in and demand for them not only in Tennessee, but throughout the entire country, and especially in all the great commercial centers, giving evidence of their importance and value as an adjunct of the service, and this demand is constantly increasing, and the fact that the information on which the weekly bulletin is based comes direct from some of the most intelligent and reliable men in the State adds no little to its value as a weekly record of the condition and prospects of those farm products of the State that have a commercial value at home and abroad. In addition to the publication of the weekly bulletin by the press of the State and of other States, about 10,000 copies are mailed during the year to the press and to individuals throughout the United States.

This report can not be closed without some expression of the obligations of the service to the corps of voluntary observers, who have so faithfully and generously given their time and performed the work during the year, some of them for eight years. Without their cheerful coöperation the service would not exist, and the country owes to them whatever of praise and gratitude may be due. Thanks are due also to the United States Signal Service observers at Knoxville, Chattanooga, Nashville, and Memphis for their uniform courtesy and cheerful coöperation in advancing the work of this service, and lastly to the Chief Signal Officer and his excellent corps of assistants for the kind and courteous support always extended the service in Tennessee.

TEXAS.

[Mr. D. D. Bryan, director; Mr. I. M. Cline, assistant director.]

SIR: I have the honor to submit the following report of the operations of the Texas weather service during the year ending June 30, 1891.

No aid is received from the State for the support of this service; the instruments, except in a few cases, where they belong to individuals, have been furnished by the United States Weather Service, and the expense of printing bulletins has been borne by the Galveston Cotton Exchange. The assistant director, Dr. I. M. Cline, has charge of all the work pertaining to the service and all duties are performed by him without other aid than that furnished from your office.

There are at present sixty-eight voluntary stations in this State, between fifty and sixty of which I believe report as a rule regularly. After these records have been examined and corrected under the supervision of the assistant director and the necessary data extracted for use here, they are forwarded to your office.

A monthly bulletin has been issued and distributed each month. There is a great demand for this publication by those seeking information relative to the climate of the State, and also by the farmers and dealers in the staple products of the State.

The feature of greatest value to farmers and also to dealers in the agricultural products of the State is the publication of the weekly weather-crop bulletin. The extent to which agriculture and commerce are interested in this publication may be judged from the fact that the demand for it is so strong during all seasons that it is necessary to issue the bulletin throughout the year. On the morning succeeding its issue it is published in all the daily papers in this State and in some papers in adjoining States, and within twenty-four hours after its issue it has reached the majority of farmers and business in the State. The bulletin is republished from the dailies in a majority of the weekly papers of the State. The substance of the bulletin is telegraphed each week in the year to the Commercial and Financial Chronicle, New York, by the special correspondent of that paper, and is also cabled to Europe. About 10,000 weekly bulletins have been issued and mailed to dealers and farmers in and outside of the State during the year, and the demand for copies for file is increasing.

Mr. Julius Runge, president of the Cotton Exchange and Board of Trade, says that the estimates as to the effects of weather conditions on the crops made by Dr. Cline in the weekly bulletins last season (which was in many respects a critical season) were remarkably accurate; and that the value of such information to all classes of persons can readily be seen when it is considered that a territory is covered which produces over 2,000,000 bales, or nearly one-fourth of the cotton crop of the United States annually. The above is quoted as a sample of the general opinion existing concerning this work and the importance attached to the same.

The publication under your orders at New Orleans, La., of a weekly bulletin covering the cotton district has met with great favor here, and is pronounced a valuable addition to the work of the National Service.

The weather forecasts and warnings have been telegraphed this year to a varying number of points. These warnings are highly appreciated and are of great value to this State. This service is increasing rapidly in popularity with the people of the State generally; but it has by no means reached the limit of its efficiency, as there remains much yet to be done. The information that the forecasts and warnings would be furnished at the expense of the National Service to fifty additional places was received with great pleasure, and it is hoped that you may find it practicable to supply even a greater number than that now authorized. It is also desired that the number of voluntary stations in the State be increased. I should like to see at least two hundred stations in the State, and it is hoped that during the present year a large number of voluntary observers may be added to the present list.

Dr. Cline has displayed the highest ability in connection with this work, which is combined with unusual energy and a clear, quick judgment, and no man better qualified could have been selected to take charge of this important service. He understands the needs of Texas, and his great interest in the service insures continued and as rapid increase as practicable in its general usefulness. It is observed, however, that both himself and assistants are overworked, and on account of the increasing demands on the State and National Services it is recommended that another assistant observer be furnished him.

I wish to thank you both for myself and for the members of the Cotton Exchange and Board of Trade for your continued assistance to this service.

WISCONSIN.

[Central office, Milwaukee; R. E. Kerkam, director.]

The following is the annual report of the work of the Wisconsin branch of the United States Weather Bureau for the year ending June 30, 1891:

Upon the arrival of the director in Milwaukee, on September 26, 1890, and after the transfer of the Signal Service property and formally assuming charge of the Milwaukee station on the day following, he at once opened communication with the meteorological committee of the Chamber of Commerce relative to the establishment of a State bureau. A meeting of the committee was held in the central office on October 10, 1890, and the plans outlined for the formal establishment of the bureau were indorsed by said committee. These plans were briefly as follows: To request the coöperation of the several commercial and agricultural associations of the State in the work, consisting of the Chamber of Commerce, the Merchant's Association, the Advancement Association, the State Agricultural Society, and the State Cranberry Growers' Association. To have at least one meteorological station established in each county in the State. To disseminate the forecasts of the Signal Service by establishing weather and temperature display stations in as many cities and towns as practicable, where the local interests demanded or requested such forecasts. To establish a system of frost warnings that would be more beneficial to the cranberry interests by having the passenger and frieght trains on the several railroad lines display the frost symbol from their trains, besides having regular display stations in the cranberry districts, where the cold-wave flag would be displayed when frost was anticipated. To have the several cities and towns purchase instruments for making observations and have the city or town councils detail an observer for the work, in this way giving the work a greater local interest. To issue a weekly weather-crop bulletin during the growing season and to issue monthly bulletins during the year.

The plan to print a monthly journal and pay for the printing by means of advertising and subscriptions has not yet been practicable, owing to the fact that the office force at headquarters was not increased, and that the time of the directors with that of the assistants was fully taken up in maintaining the current work of the station and extending the work of the State bureau gradually.

The plans above outlined have been carried into effect as far as practicable. There are at present seventy-three stations where observations are made by volunteer observers, and the central office receives the monthly reports from five Signal Service stations in the State, and closely surrounding, making a total of seventy-eight meteorological stations. There are forty-two stations where weather and temperature flags are displayed in the State; four railroad lines that carry the frost symbols through the cranberry districts, and eight prominent points in these districts where the frost symbol is displayed from staffs.

Weekly reports are received from nearly four hundred crop correspondents, and these reports are used in the compilation of the weekly weather-crop bulletins issued each Saturday during the growing season. These bulletins are a leading feature of the State bureau work. They are published by the majority of the State papers, and the Chicago papers publish them regularly. The several favorable comments received, editorially and otherwise, prove that this feature of the work is appreciated by the press and public, and the correspondents, who are for the most part practical farmers and business men, are unanimous in their praise of the bulletins.

The monthly bulletins contain the meteorological features of the month for the State. As a meteorological record, giving statistical information of great value to all portions of the State, these bulletins meet with universal favor. There was formerly a great portion of northern and central Wisconsin where no meteorological records were kept, and to obtain accurate records of the temperature, rainfall, etc., was very desirable to the several business interests of that portion of the State, and these records are now being made in all the northern and central counties, laying a foundation for a valuable record of the climate in years to come.

The formal indorsement of the State bureau by the commercial and agricultural bodies was made during the winter.

The interest in the State work is constantly increasing to such an extent that it has been with difficulty that the limited office force could cope with it; and it has been necessary to limit the ever-increasing demands to the work that could be performed at the office by refusals to establish additional stations where observers could be secured, and by limiting crop correspondents and other work that would have swelled the duties of the office to an unlimited degree.

The plan to have the several cities and towns purchase standard self-registering thermometers, a rain-gauge, and shelter, and appoint an interested person as observer was very successful. There are now thirty-five places in the State where the instruments are personal property, and thirty stations where the Signal Service has loaned the observers instruments with which to make observations. The education of the several observers has been a pleasant though arduous personal task to the director, the correspondence having assumed such proportions that it was with difficulty maintained. At the present time, however, the corps of observers, with but one or two exceptions, are fully instructed and capable of making excellent records.

There was no financial aid asked from the State or from the coöperating bodies, and the entire expense of the service has therefore been borne by the national bureau, save for the incidental expenses which were defrayed from personal funds. There is no doubt but that the next general State assembly will make an ample appropriation for continuing the work should such a course be deemed advisable at that time by the chief of the weather bureau, since the governor and the several members of the State legislature who have been brought into contact with the State bureau are ardently in favor of aught that will increase the benefits to be derived from the work.

The past spring has proven the practical utility of the work of the State bureau. The long and severe drought in this State made news of an official character relative to the rainfall and crop conditions particularly valuable to the several business interests, and this information was given weekly and monthly in the bulletins issued by the central office. The Chamber of Commerce became so deeply interested in the State bureau work that it required but a suggestion to have them have a large bulletin board erected on which to post the weekly weather-crop bulletins from all States having State services.

APPENDIX 7.

REPORT OF THE OFFICER IN CHARGE OF THE STATIONS DIVISION.

WASHINGTON CITY, *June 30, 1891.*

SIR: I have the honor to submit the regular annual report of the Stations Division of this office for the year ending June 30, 1891.

CLERICAL FORCE.

Very little change has been made in the clerical force, it having been reduced to the lowest limit consistent with efficiency during the previous year. The clerks are thoroughly competent, and in addition have such a knowledge of the division as to be able to attend to the duties of those who may be absent from time to time by reason of leave or sickness. Their services in such cases are utilized in the manner indicated, so that by dividing up duties at desks where the regular clerk may be temporarily absent, everything is kept up to date.

FORCE AT STATIONS.

At this date the regular force at stations of the first, second, and third orders, and at stations on the telegraph lines, is as follows: Sergeants, 121; corporals, 15; first-class privates, 124; second-class privates, 2; civilians formerly enlisted men, but reëmployed under act of Congress approved October 1, 1890, 40; other civilians employed to fill vacancies, 17; aggregating a total force of 319. Last year the total number of employés at stations of the classes named was 298.

In addition to the above, 49 assistants, river observers and messengers, receiving salaries above $5 per month, are temporarily employed at regular meteorological stations and paid out of the sub-appropriations for maps and bulletins, river and flood reports, cotton region reports, or rents of offices etc.

By operation of law the enlisted men acting as observers, etc., will, after this date, sever their connection with the military establishment, and such as desire be employed under the Department of Agriculture, as members of the new Weather Bureau, and be continued in their present lines of duty.

DUTIES.

The duties of the division have been the same as set forth in detail in the report of last year, consisting of the general administration of the stations of the service and of the employés and their work; they have been performed with promptness and alacrity.

There has been a large increase of work in connection with the issue of daily weather maps and the daily forecasts, the benefits of which have been extended to many additional places which could be reached in time to make the information of value to the recipients.

The assignment, control, and instruction of the enlisted force and of the paid civilian observers, except at special river and rainfall stations, has remained in the division.

The clerical work is attended to promptly, and no portion of the duties connected with the division is permitted to run behind.

The work at the various stations has been critically investigated, and as a result has been simplified in many ways and its efficiency increased without additional cost or labor. It is thought well in this connection to state in brief the duties performed at the stations of the various classes.

They are as follows:

STATIONS OF THE FIRST ORDER.

Make observations daily at 8 a. m. and 8 p. m. of barometer, temperature, dew-point and relative humidity, wind and weather precipitation, if any, and stage of water in the river (in case of river stations), record and encipher the same in a telegram, and deliver it to the telegraph office within twenty minutes for transmission to this office.

At certain designated stations the observers are required to be at the telegraph offices at each circuit hour (twice daily) and transfer the reports from selected stations, in order that they may be distributed by telegraph over other circuits.

Make a. m. or p. m. (or both) weather map or bulletin, at stations authorized to do so, and distribute them throughout the city and deliver copies to the post-office or at the railroad depots for transmission by mail.

Receive weather forecasts, wind-signals, and cold-wave orders and distribute the same by telegraph or telephone throughout the city and to authorized points in the adjacent territory, and receive and distribute cotton-region reports.

Record continuously, by means of self-registering instruments, important meteorological phenomena, such as wind direction and velocity, precipitation, temperature, barometric pressure, amount of sunshine, etc. In addition to the foregoing, the observers perform other special and variable duties too numerous to classify.

The observers render weekly, monthly, quarterly, and annual reports and returns, and also audit the accounts from their substations.

STATIONS OF THE SECOND ORDER.

With the exception that they do not keep a full record by means of self-registering instruments, the observers perform the same duties as at stations of the first order.

STATIONS OF THE THIRD ORDER.

Make one observation daily, at 8 p. m., of maximum and minimum temperature, direction of wind, state of weather and precipitation, if any, and perform such other duties in connection with the United States military telegraph lines, display stations, or with State weather services as may be assigned.

REPAIR STATIONS ON TELEGRAPH LINES.

Perform the usual telegraph duties and keep the lines in repair. The observers are also the repairmen. They make a record daily of the precipitation, if any, and send a report of the same monthly to this office by mail.

STATE WEATHER SERVICE STATIONS.

These are stations of either the second or third order and the observers perform the duties incident to stations of those classes. In addition they coöperate with or act for the State weather service in collecting and disseminating meteorological information bearing on the climatological conditions of the State and relative to the growth of its staple crops. They issue weekly and monthly crop bulletins and other publications.

In connection with the foregoing defined duties at the various classes of stations it should be remembered that the duties of the various stations of the same order differ very materially, and while those of each specified class may not perform all the duties detailed herein, they all take the observations indicated and render regular reports to this office by mail.

SPECIAL DISPLAY STATIONS.

Special display stations are established for the purpose of announcing wind storms on the northern lakes and on the seacoast.

Warnings of the approach of wind storms are given by the display of flags by day and lanterns by night. Bulletins are also made and posted in conspicuous public places, and copies of the warning message are furnished to newspapers, mariners, and others. On the Pacific coast only day signals are displayed at present.

Special display stations are grouped in sections, each section being under the direction of a neighboring meteorological station, designated the section center.

Orders to display signals are sent from the office of the Chief Signal Officer to the observer in charge of the section center, who at once distributes them by telegraph or telephone to the several stations in his section.

The duties of displaymen consist in hoisting and lowering the proper signals, in compliance with instructions received by telegraph or telephone, and in rendering monthly and quarterly reports.

Each station is supplied with a flagstaff, full set of flags, one red and one white lantern, a wind vane, and the necessary stationery and blank forms.

Displaymen receive all their instructions from and render all reports and bills to the observer in charge of their respective centers.

The signals adopted for announcing the approach of wind storms are as follows:

(1) *A cautionary signal*, a yellow flag (8 feet square) with white center, will indicate that the winds expected are not so severe but well-found and seaworthy vessels can meet them without great danger.

(2) *A storm signal* a red flag (8 feet square) with a black center, will indicate that the storm is to be of more marked violence.

(3) *A red pennant* (5 feet hoist and 12 feet fly) will indicate that the winds are to be easterly—that is, from northeast to south, inclusive, and that the storm center is approaching.

(4) *A white pennant* (5 feet hoist and 12 feet fly) will indicate westerly winds—that is, from north to southwest, inclusive, and that the storm center has passed.

(5) *When red pennant* is hoisted *above* the cautionary or storm signal, winds are expected from the *northeast quadrant;* when *below*, from the *southeast quadrant.*

(6) *When white pennant* is hoisted *above* the cautionary or storm signal, winds are expected from the *northwest quadrant;* when *below*, from the *southwest quadrant.*

(7) *Night signals.*—A red light will indicate easterly winds; a white *above* a red light will indicate westerly winds.

(8) *Information signal.*—The "information signal" consists of a yellow pennant, of the same dimensions as the red and white pennants (wind-direction signals), and when displayed indicates that the local observer has received information from the central office of a storm covering a limited area, dangerous only for vessels about to sail to certain points. The signal will serve as a notification to shipmasters that the necessary information will be given them upon application to the local observer.

SPECIAL RIVER STATIONS.

The special river system of this Service provides for regular observations and reports of the stage of water at favorable points on the principal rivers in the United States, by which the water level is reported daily to designated centers. During periods of danger from floods or unusually high water, observations are taken and telegraphed as often as is considered necessary in the public interests.

These stations are of special importance to river commerce in furnishing daily reports of the water in the tributaries of the principal rivers, in order that the future supply, for the purposes of navigation, may be determined.

At meteorological stations located on rivers daily observations of the stage of water form part of the regular duties. At special river stations observers are appointed for the purpose.

Observations.—Observations at special river stations consist of taking and recording, at 8 a. m., daily, (1) the depth of water in the river; (2) the state of weather; (3) direction of wind; (4) amount of rain or snow fall (if any) since last observation; (5) time of beginning and ending of rain or snow; (6) depth of unmelted snow (if any) on the ground.

Observations, how reported.—Observations, when telegraphed, are reduced to brief dispatches (in cipher), and are sent to the district center; when forwarded by mail, the report is sent on a postal card to the observer in charge of the district center.

Centers.—Centers are located at meteorological stations in cities where the reports can be most advantageously collected and published for the benefit of those interested in river commerce.

Instructions, reports, bills.—Special river observers receive instructions from, and render reports and bills for services to, the observers in charge of centers.

Supplies.—All supplies (except river gauge) are furnished by the section center.

Public property lost or destroyed must be accounted for by affidavit or other satisfactory evidence.

River gauges.—River gauges are of four kinds. The kind to be used at each station is determined by the local conditions.

Specifications and illustrations, to be followed in constructing the gauges, are furnished in the "Instructions to Special River Observers."

COTTON-REGION STATIONS.

The cotton-region service is for the purpose of furnishing information as to heavy rains, drought, frost, violent windstorms, and sudden and decided changes in temperature, in order that cotton exchanges, cotton merchants, and others interested, may, at frequent intervals, be enabled to form a comparatively reliable estimate of the condition of the growing crops.

The daily reports of the maximum and minimum temperatures and rainfall are received with reliability and rapidly disseminated throughout the commercial centers of the cotton region from May 1 to November 30, each year. The occurrence of frosts and destructive storms is also reported.

The cotton-growing region of the United States is, in order to secure the best telegraphic facilities, divided into districts, formed with reference to existing coöperating railroad lines. The districts embrace the territory adjacent to the more important cities in the Southern States where full reporting meteorological stations are located. Each district has a center for the concentration of reports from the several special stations, and the name of this center is used to designate the district. Observers receive their instructions from, and render reports and bills to observers in charge of their respective centers.

Each special cotton-region station is supplied with an instrument shelter, one maximum thermometer, one minimum thermometer, one rain gauge and measuring stick.

One observation is taken daily at each station, at 5 p. m., central time (or 6 p. m., eastern time), consisting of the maximum temperature, the minimum temperature, amount of rainfall in past twenty-four hours, occurrence of light or killing frost, or destructive storms, tornadoes, or violent thunderstorms. This observation is enciphered and telegraphed to the observer in charge of the center to which the special cotton-region station belongs.

Observers in charge of section centers having received all the reports from the stations in their respective districts, make up the mean maximum temperature, the mean minimum temperature, and average rainfall for the district. These means are then enciphered and telegraphed at the midnight circuit hour over certain specified circuits, and observers at the regular stations on these circuits use the data in preparing a bulletin for general information. Each center also issues bulletins containing reports from the stations in that district and posts a copy at each of the exchanges and at such other places as will best serve the public interests.

SPECIAL RAINFALL STATIONS.

Special rainfall stations are established for the purpose of increasing the value and accuracy of reports of the stage of water in the larger navigable rivers of the United States for the benefit of commerce and river navigation and in order to render accurate flood predictions possible. When specially heavy rainstorms occur (of 1½ inches or more of rainfall) the observer in charge of the section center adds the names of the stations reporting the same, and the amount of rainfall thereat to his regular telegraphic report.

These stations are located at suitable points on the watersheds, at the sources, and on the principal tributaries of the large rivers.

Duties of observers.—The duties of special rainfall observers consist in measuring and recording at 2 p. m., daily, the amount of rain that has fallen during the preceding twenty-four hours and entering it on a weekly form (postal card) prepared for the purpose. On Friday of each week the card is sent by mail to the observer in charge of the center to which the station belongs.

The observer in charge of the section center, immediately upon receipt of the cards, furnishes press reports to such newspapers as desire to publish the information.

Rainfall stations are arranged in sections, and each section center receives the reports from the several special stations and disseminates the information so as to subserve the best interests of the public.

With rare exceptions rainfall observers receive all their instructions from, and render all reports and bills for services to, the observers in charge of their respective sections.

STATIONS BY STATES.

The report of last year contained a full list of each of the various class of stations, grouped by States. Since that time the changes made are shown in the following list. Stations have been opened and closed during the year as follows:

Stations.	Date.
SECOND ORDER.	
Established.	
Red Wing, Minn	Sept. 10, 1890
Oklahoma, Okla	Oct. 17, 1890
Furnace Creek (Death Valley) Cal	Mar. 21, 1891
Discontinued.	
Boisé City, Idaho	July 1, 1890
New Brunswick, N. J.	Sept. 20, 1890
Whipple Barracks, Ariz	Do.
Fort Elliott, Tex	Oct. 4, 1890
Colorado Springs, Colo.	Nov. 4, 1890
Bethel, Alaska	Nov. 17, 1890
Lexington, Ky	Dec. 31, 1890
St. Vincent, Minn	Do.
Yankton, S. Dak	Mar. 31, 1891
THIRD ORDER.	
Established.	
Holbrook, Ariz	Aug. 15, 1890
Minneapolis, Minn	Sept. 10, 1890
Ithaca, N. Y	Oct. 1, 1890
New Brunswick, N. J.	Do.
Carthage, N. Mex	Oct. 20, 1890
St. Vincent, Minn	Dec. 31, 1890
Discontinued.	
Fort Maginnis, Mont	July 1, 1890
Fort Verde, Ariz	Aug. 1, 1890
Anvik, Alaska	Sept. 12, 1890
Lava, N. Mex	Oct. 20, 1890
REPAIR STATIONS.	
Discontinued.	
Galpin, Mont	July 1, 1890
Kintyre, Mont	Do.
Holbrook, Ariz	Aug. 15, 1890
Miami, Tex	Sept. 30, 1890
Carter, Wyo	Oct. 25, 1890
Neah Bay, Wash	May 31, 1891
DISPLAY STATIONS.	
Established.	
Fall River, Mass	Apr. 1, 1891
Bangor, Me	Apr. 10, 1891
Bayfield, Wis	May 1, 1891
Aberdeen, Wash	Do.
Discontinued.	
Chicago Water Crib, Chicago, Ill	Nov. 30, 1890
Gay Headlight, Mass	Jan. 1, 1891
Appalachicola, Fla	Mar. 15, 1891
Bristol, R. I	Mar. 31, 1891
Peachton, Ohio	May 15, 1891

Stations.	Date.
SPECIAL RIVER STATIONS.	
Established.	
[Also taking rainfall observations.]	
Mount Carmel, Ill	Oct. 24, 1890
Lock Haven, Pa	Do.
Wilkesbarre, Pa	Do.
Harrisburg, Pa	Do.
Huntingdon, Pa	Do.
Rome, Ga	Do.
Gadsden, Ala	Do.
Wilsonville, Ala	Do.
Salisbury, Ala	Do.
Tallassee Falls, Ala	Do.
Montgomery, Ala	Do.
Selma, Ala	Do.
Bartonville, Ala	Do.
Chester, Ala	Do.
Long Bridge, D. C	June 1, 1891
Bismarck, N. Dak	Do.
Pierre, S. Dak	Do.
St. Paul, Minn	Do.
Tuscaloosa, Ala	Oct. 24, 1890
Claiborne Landing, Ala.	Do.
Florence, Ala	Do.
Burkesville, Ky	Do.
West Newton, Pa	Do.
Fayetteville, N. C	Do.
Danville, Va	Do.
Clarksville, Va	Do.
Weldon, N. C	Do.
Alton, Ill	Do.
Chester, Ill	Do.
Cape Girardeau, Mo	Do.
Warren, Pa	Do.
Parkers Landing, Pa	Do.
Clarion, Pa	Do.
Freeport, Pa	Do.
Johnstown, Pa	Do.
Saltsburg, Pa	Do.
Greensboro, Pa	Do.
Lillington, N. C	Do.
Peoria, Ill	Do.
Red River City, Tex	Dec. 1, 1890
Eagle Pass, Tex	Dec. 5, 1890
Laredo, Tex	Do.
Cordova, Ala. (K. C., Mem. & Bir. R. R.)	Do.
Columbus, Miss	Do.
Cordova, Ala. (Ga. Pac. R. R.)	Do.
Shawneetown, Ill	Jan. 31, 1891
Arthur City, Tex	Do.
Camden, S. C	Feb. 28, 1891
Cheraw, S. C	Mar. 31, 1891

Stations by States—Continued.

Stations.	Date.	Stations.	Date.
SPECIAL RIVER STATIONS—cont'd.		SPECIAL COTTON-REGION STATIONS—cont'd.	
Established—Continued.		*Discontinued.*	
Wateree, S. C. (on the Congaree)	Mar. 31, 1891	Howe, Tex	May 31, 1891
Wateree, S. C. (on the Wateree)	Do.	SPECIAL RAINFALL STATIONS.	
Effingham, S. C	Do.	*Established.*	
Nichols, S. C	Do.	Motes, Winston Co., Ala	Oct. 24, 1890
Tellers Ferry, S. C	Do.	Talladega, Talladega Co., Ala	Do.
Discontinued.		New Castle, Pa	Do.
Grand Tower, Ill	Oct. 24, 1890	Stoyestown, Pa	Do.
Bartonville, Ala	Nov. 30, 1890	Ridgeway, Pa	Do.
Chester, Ala	Do.	Du Bois, Pa	Do.
Eddyville, Ky	Jan. 12, 1891	Oak Ridge, Guilford Co., N. C	Do.
Red River City, Tex	Feb. 1, 1891	Chapel Hill, Orange Co., N. C	Do.
SPECIAL COTTON-REGION STATIONS.		*Discontinued.*	
Established.			
Sherman, Tex	June 1, 1891	Tracy, Minn	May 15, 1891

NOTE.—The name of the special rainfall station at Charleston, N. C., was, on January 31, 1891 changed to Bryson City, N. C.

RECAPITULATION.

STATIONS ESTABLISHED AND DISCONTINUED DURING THE YEAR.

	Established.	Discontinued.
Stations of the second order	3	9
Stations of the third order	6	4
Repair stations	0	6
Display stations	4	5
River stations	53	5
Cotton-region stations	1	1
Rainfall stations	8	1
Total	75	31

STATIONS OF THE SIGNAL SERVICE IN OPERATION ON JUNE 30, 1891.

Stations of the first order (making continuous records by means of self-registering instruments)	*26
Stations of the second order (taking two observations daily)	*116
Stations of the third order (taking one observation daily at 8 p. m.)	*30
Repair stations on United States military telegraph lines	12
Special display stations	76
Special river stations	112
Special cotton-region stations	115
Special rainfall stations	53
State weather service station, taking no observation (Cambridge, Mass.)	1
Total stations in operation	541

*Including also stations coöperating with the State weather services.

STATISTICAL TABLE OF STATIONS.

The following table has been compiled for incorporation in this report, as it is thought, in view of the change in the status of the Signal Service, that the information will be valuable for future reference.

The table shows the stations of the first and second orders on June 30, 1891:

[The letter a indicates that wind signals are displayed; b, river observations are taken; c, cotton-region observations are taken; d, cold-wave signals are displayed; e, the station is a center to which special rainfall stations report; f, information signals are displayed; g, State weather service work is done; h, the station is open during the summer months only.]

Stations.	Date of establishment of station.	Observers, etc., on duty.	Regular reports telegraphed daily to the central office.	A. m. maps issued daily.	P. m. maps issued daily.	Places furnished the regular official forecasts daily (except Sunday) by telegraph.	Places furnished cold-wave warnings only by telegraph.	Special duties and data.
First order.								
Boston, Mass	Nov. 1, 1870	10	2	254	282	25	2	a, d, f, g.
Buffalo, N. Y	do	4	2		95	12		a, d, f.
Chicago, Ill	do	7	2	97	208	54	4	a, d, f.
Cincinnati, Ohio	do	7	2	58	108			b, d, e.
Cleveland, Ohio	do	3	2	53				a, d, f.
Denver, Colo	Nov. 19, 1871	3	2	18		1	1	d, g.
Detroit, Mich	Nov. 1, 1870	4	2		92	14		a, d, f.
Dodge City, Kans	Sept. 15, 1874	1	2					b, d.
Duluth, Minn.*	Nov. 1, 1870	2	2	8				a, d, f.
Eastport, Me	Apr. 1, 1873	2	2					a, f.
Galveston, Tex	Apr. 19, 1871	4	2	20		18		a, c, d, f.
Kansas City, Mo	July 1, 1888	7	2	99	107	58	2	b, d, e.
Memphis, Tenn	Feb. 28, 1871	3	2	41		11	6	b, c, d.
New Orleans, La	Nov. 1, 1870	4	2	70		18	26	a, b, c, d, f, g.
New York City	do	9	2	180	225	34	3	a, d, f.
Philadelphia, Pa	Jan. 1, 1871	5	2	41		20	3	d, g.
Pittsburg, Pa	Nov. 1, 1870	4	2	63		30	1	d, d, e.
Portland, Oregon	Nov. 1, 1871	3	2					d, g.
St. Louis, Mo	Nov. 1, 1870	8	2	81	55	32	3	d, d, e.
St. Paul, Minn	do	3	2	28		29		b, d, e.
Salt Lake City, Utah	Mar. 19, 1874	2	2					
Savannah, Ga	Jan. 1, 1871	2	2	30				a, c, d, f.
Santa Fé, N. Mex	Nov. 20, 1871	1	2					
San Diego, Cal	Nov. 1, 1871	1	2					
San Francisco, Cal	Mar. 8, 1871	4	2	82		35		
Washington City	Nov. 1, 1870	2		325	230	62	54	d.
Second order.								
Abilene, Tex	Sept. 15, 1885	1	2					c, d.
Albany, N. Y	Dec. 22, 1873	3	2					d.
Alpena, Mich	Sept. 10, 1872	1	2					a, d, f.

* Maps issued during navigation only.

Statistical table of stations—Continued.

Stations.	Date of establishment of station.	Observers, etc., on duty.	Regular reports telegraphed daily to the central office.	A. m. maps issued daily.	P. m. maps issued daily.	Places furnished the regular official forecasts, daily (except Sunday), by telegraph.	Places furnished cold-wave warnings only by telegraph.	Special duties and data.
Second order—Cont'd.								
Assinniboine, Fort, Mont.	Oct. 6, 1879	1	2					
Atlantic City, N. J.	Sept. 25, 1878	3	2	18				b, c, d.
Atlanta, Ga	Dec. 10, 1873	2	2					a, f.
Augusta, Ga	Nov. 2, 1870	2	2	20				b, c, d.
Baker City, Oregon	July 1, 1889	1	2					
Baltimore, Md	Jan. 1, 1871	5	2					a, d, f.
Bismarck, N. Dak	Sept. 15, 1874	5	2					
Block Island, R. I	Sept. 1, 1890	3	2					a, f.
Brownsville, Tex	Aug. 25, 1875	3	2					
Buford, Fort, N. Dak	Oct. 23, 1878	1	2					d.
Cairo, Ill	June 1, 1871	2	2	28				b, d, e.
Canby, Fort, Wash	Sept. 1, 1883	1	2					a.
Charleston, S. C	Jan. 5, 1871	2	2				2	a, c, d, f.
Charlotte, N. C	Oct. 6, 1878	2	2					c, d.
Chattanooga, Tenn	Jan. 8, 1879	2	2	34				b, c, d, e.
Cheyenne, Wyo	Nov. 1, 1870	1	2				1	d.
Columbus, Ohio	July 1, 1878	3	2	25		29	1	d, g.
Concordia, Kans	Jan. 27, 1885	1	2					d.
Corpus Christi, Tex	Oct. 1, 1886	1	2					a, d, f.
Custer, Fort, Mont	Dec. 5, 1878	2	2					
Davenport, Iowa	May 24, 1871	3	2	17				d, f.
Des Moines, Iowa	Aug. 1, 1878	3	2	25				d, g.
Dubuque, Iowa	July 10, 1873	1	2					b, d, e.
Du Chesne, Fort, Utah.*	Sept. 1, 1887	1						
El Paso, Tex	Nov. 5, 1877	1	2					
Erie, Pa	May 25, 1873	2	2	50				a, d, f.
Eureka, Cal	Dec. 1, 1886	1	2					a.
Fort Smith, Ark	June 1, 1882	1	2					b, c, d, e.
Fresno City, Cal	July 26, 1887	1	2					
Grand Haven, Mich	May 24, 1871	2	2					a, d, f.
Grant, Fort, Ariz	Nov. 1, 1875	2	2					
Green Bay, Wis	Sept. 1, 1886	1	2					a, d, f.
Green Mountain, Me.*	May 1, 1889	1						h.
Harrisburg, Pa	July 1, 1888	2	2		181			d, d.
Hatteras, N. C	Dec. 1, 1880	1	2					a, f.
Helena, Mont	Oct. 15, 1879	1	2					
Huron, S. Dak	July 1, 1881	2	2	10				d, g.
Indianapolis, Ind	Feb. 10, 1871	5	2	21		45	1	d, g.
Jacksonville, Fla.†	Sept. 11, 1871	2	2	18		6	15	a, d, f.

* Two observations taken daily but not telegraphed.
† Maps issued from November 15, to May 15.

Statistical table of stations—Continued.

Stations.	Date of establishment of station.	Observers, etc., on duty.	Regular reports telegraphed daily to the central office.	A. m. maps issued daily.	P. m. maps issued daily.	Places furnished the regular official forecasts, daily (except Sunday), by telegraph.	Places furnished cold-wave warnings only by telegraph.	Special duties and data.
Second order—Cont'd.								
Jupiter, Fla	Jan. 1, 1888	2	2					a.
Keeler, Cal	Feb. 1, 1885	1	2					
Keokuk, Iowa	July 16, 1871	1	2					b, d, e.
Key West, Fla	Nov. 1, 1870	2	2					a, f.
Knoxville, Tenn	Jan. 1, 1871	1	2	8				b, d.
La Crosse, Wis	Oct. 15, 1872	1	2					b, d, c.
Lansing, Mich.*	Oct. 25, 1886	1				52		d, g.
Leavenworth, Kans.*	....do	1						d.
Little Rock, Ark	July 1, 1879	3	2	9		11		b, c, d, g.
Los Angeles, Cal	July 1, 1877	3	2					
Louisville, Ky	Sept. 11, 1871	3	2	19		10	4	b, d, e, g.
Lynchburg, Va	May 24, 1871	2	2				1	d.
Manchester, N. H.*	Nov. 13, 1886	1						d.
Manistee, Mich.†	July 1, 1888	1	2	7				a, f.
Marquette, Mich	May 1, 1871	1	2				1	a, d, f.
McKinney, Fort, Wyo	July 5, 1887	1	2					
Meridian, Miss.‡	July 1, 1889	2	2	16				c, d.
Milwaukee, Wis	Nov. 1, 1870	3	2	62		42		a, d, f,
Mobile, Ala	Nov, 7, 1870	2	2					a, c, d, f.
Montgomery, Ala	Nov. 9, 1870	2	2			5		c, d, e.
Montrose, Colo	Feb. 5, 1885	1	2					d.
Moorhead, Minn	Jan. 1, 1881	1	2					d.
Mt. Killington, Vt.*	July 1, 1889	1						h.
Mt. Washington, N.H.*	Dec. 1, 1870	1						h.
Nantucket, Mass	Feb. 4, 1886	4	2					a, f.
Nashville, Tenn	Nov. 1, 1870	4	2	40		6		b, c, d, e, g.
New Haven, Conn	Dec. 10, 1872	3	2	51				d, f.
New London, Conn	Jan. 10, 1871	1	2					a, d, f.
Norfolk, Va	Jan. 1, 1871	4	2	17				a, d, f.
Northfield, Vt	Nov. 13, 1886	1	2					
North Platte, Nebr	Sept. 15, 1874	1	2					d.
Oklahoma, Okla	Oct. 17, 1890	1	2				1	d.
Olympia, Wash	July 1, 1877	1	2					
Omaha, Nebr	Nov. 1, 1870	2	2			53	1	b, d.
Oswego, N. Y	....do	2	2			9		a, d, f.
Palestine, Tex	Dec. 3, 1881	1	2					c.
Parkersburg, W. Va	July 1, 1888	1	2					b, d.
Pensacola, Fla	Oct. 27, 1879	2	2	20				a, f.

* Two observations taken daily but not telegraphed.
† Maps issued during navigation only.
‡ Maps issued from March 1 to November 30.

Statistical table of stations—Continued.

Stations.	Date of establishment of station.	Observers, etc., on duty.	Regular reports telegraphed daily to the central office.	A. m. maps issued daily.	P. m. maps issued daily.	Places furnished the regular official forecasts daily (except Sunday), by telegraph.	Places furnished cold-wave warnings only by telegraph.	Special duties and data.
Second order—Cont'd.								
Port Angeles, Wash.*	Feb. 1, 1885	4						a.
Port Huron, Mich	July 25, 1874	1	2					a, d, f.
Portland, Me	Jan 15, 1871	2	2	31				a, d, f.
Pueblo, Colo	June 1, 1888	1	2					d.
Raleigh, N. C	Oct. 25, 1886	1	2			25		c, d, e, g.
Rapid City, N. Dak	Jan. 1, 1888	1	2					c, d.
Red Bluff, Cal	July 1, 1887	1	2					
Red Wing, Minn*	Sept. 10, 1890	1						a, d.
Rio Grande City, Tex	May 28, 1875	2	2					
Rochester, N. Y	Nov. 1, 1870	2	2					d.
Roseburg, Oregon	July 15, 1877	1	2					
Sacramento, Cal	July 1, 1877	1	2					
San Antonio, Tex	Sept. 22, 1875	1	2					e.
Sandusky Ohio	Aug. 12, 1877	2	2	36				a, d, f.
Sault Ste. Marie, Mich	Apr. 1, 1883	1	2					a, d, f.
Shreveport, La. †	Sept. 3, 1871	2	2	14				b, c, d.
Sill, Fort, Okla	June 23, 1875	2	2					
Sioux City, Iowa	July 1, 1889	2	2	26				b, d.
Spokane Falls, Wash	Feb. 5, 1881	1	2					
Springfield, Ill	July 1, 1879	3	2	38				d, g.
Springfield, Mo	Jan. 3, 1882	1	2					d.
Stanton, Fort, N. Mex	Jan. 1, 1885	1	2					
Sully, Fort, S. Dak	May 1, 1872	1	2					
Tampa, Fla. ‡	Mar. 13, 1890	1	2	18				
Titusville, Fla	July 1, 1887	3	2					d.
Toledo, Ohio	Nov. 1, 1870	2	2	49				a, d, f.
Valentine, Nebr	Jan. 27, 1885	1	2					d.
Vicksburg, Miss	Sept. 10, 1871	3	2	34				b, c, d.
Walla Walla, Wash	Dec. 1, 1885	1	2					
Washakie, Fort, Wyo	Dec. 1, 1881	2	2					
Wichita, Kans	July 1, 1883	1	2					d.
Wilmington, N. C	Jan. 1, 1871	3	2	12				a, c, d, f.
Winnemucca, Nev	July 1, 1877	1	2					
Yuma, Ariz	Nov. 18, 1873	1	2					

* Two observations taken daily but not telegraphed.
† Maps issued from April 1 to October 31.
‡ Maps issued from November 1 to March 31.
Columbia, S. C., is a State weather service station, and furnishes forecasts by telegraph daily, except Sunday, to twenty places for use in the display of weather signals.
The third-order station at Minneapolis, Minn., issues sixteen a. m. maps daily, and is a State weather service station, displaying cold-wave signals.

Hours of duty at stations.—In connection with the stations it might be well to say that the average daily hours of duty of each man at the regular first and second order stations of the service, as compiled from the detailed reports of observers, are about 8.6 hours.

During the year 2,016 monthly abstracts of journal have been examined; the acknowledgments of all general orders, circulars, and circular letters mailed to stations have been checked, and the correspondence division notified as to all general orders and circulars reported missing from station files.

A monthly report showing absence of the enlisted men on station on account of sickness, and cost of medical attendance and medicines for them, has been rendered to the Chief Signal Officer for his information and that of the disbursing officer of this service.

Three hundred and thirty-eight changes in stations of the enlisted men (and those who have become civilians since the act of October 1, 1890) have been made in special orders on the recommendations of the stations officer.

Total number of days the enlisted men of the Signal Corps were absent from duty on account of sickness during the fiscal year, 1,342; 1.3 per cent.

Total number of days the men (the enlisted men and those who have become civilians since the act of October 1, 1890) of the Signal Corps were absent from duty on account of leaves of absence and furloughs granted during the fiscal year, 3,310½; 3.2 per cent.

REMOVAL OF OFFICES.

It has been found necessary, in the public interests, to remove the signal offices at the following places, either to secure better exposure of instruments, greater efficiency in connection with the business interests, or, other things being equal, to secure public quarters free of rent:

Atlanta, Ga., May 30, 1891.
Augusta, Ga., May 1, 1891.
Baltimore, Md., May 31, 1891.
Charlotte, N. C., Apr. 1, 1891.
Denver, Colo., May 1, 1891.
Detroit, Mich., Nov. 16, 1890.
Duluth, Minn., Apr. 1, 1891.
Fresno, Cal., Sept. 30, 1890.
Green Bay, Wis., May 1, 1891.
Helena, Mont., May 1, 1891.
Huron, S. Dak., May 1, 1891.
Memphis, Tenn., Nov. 1, 1890.
Pueblo, Colo., Feb. 28, 1891.
Roseburg, Oregon, July 1, 1890.
Spokane Falls, Wash., Nov. 6, 1890.
Valentine, Nebr., Dec. 31, 1890.
Wilmington, N. C., Apr. 13, 1891.
Carson City, Nev., June 1, 1891.

STATIONS LOCATED IN PUBLIC BUILDINGS.

The following list shows the places in which office rooms have been secured in public buildings, free of cost; also public buildings in which Signal Service offices are located:

Albany, N. Y., U. S. post-office building.
Apache, Fort, Ariz., U. S. military post building.
Assinniboine, Fort, Mont., U. S. military post building.
Atlanta, Ga., U. S. post-office building.
Auburn, Ala., State Agricultural and Mechanical College.
Augusta, Ga., U. S. post-office building.
Baltimore, Md., U. S. custom-house building.
Bismarck, N. Dak., quartermaster's building.
Boston, Mass., post-office building.
Bowie, Fort, Ariz., military post.
Buford, Fort, N. Dak., military post.
Cairo, Ill., U. S. custom-house and post-office building.
Canby, Fort, Wash., Signal Service building.
Cape Henry, Va., Signal Service building.
Carson City, Nev., U. S. court-house and post-office building.
Charlotte, N. C., U. S. post-office building.
Chattanooga, Tenn., county court-house.
Cincinnati, Ohio, U. S. custom-house.
Columbia, S. C., State Agricultural College.
Crete, Nebr., Boswell Observatory, Doane College.
Custer, Fort, Mont., military post building.
Columbia, Mo., experimental station building.
Des Moines, Iowa, U. S. post-office.
Du Chesne, Fort, Utah, military post building.

Erie, Pa., U. S. court-house and post-office.
Furnace Creek, Cal., Smith's borax camp (not in public building, located in said camp in Death Valley, with no expense for rent).
Rio Grande City, Tex., canteen building, military post.
St. Louis, Mo., U. S. post-office and custom-house.
St. Vincent, Minn., railroad telegraph office.
San Antonio, Tex., headquarters Department of Texas.
Sandusky, Ohio, U. S. custom-house.
Shreveport, La., U. S. post-office and custom-house.
Sill, Fort, Okla., military post building.
Southport, N. C., Signal Service building.
Springfield, Ill., U. S. post-office building.
Sully, Fort, S. Dak., military post building.
Stanton, Fort, N. Mex., military post building.
Tatoosh Island, Wash., Signal Service building.
Thomas, Fort, Ariz., military post.
Toledo, Ohio, U. S. custom-house.
Topeka, Kans., Washburn College.
University, Miss., building in university grounds.
Washakie, Fort, Wyo., military post building.
Washington, D. C., Signal Service buildings, Twenty-fourth and M streets NW.
Wilmington, N. C., U. S. custom-house and post-office.
Woods Holl, Mass., Fish Commission building.
Yates, Fort, N. Dak., military post building.
Yuma, Ariz., quartermaster's building.

CAUTIONARY AND STORM SIGNALS SERVICE.

This subject has been exhaustively treated in past years and little remains to be added. However, it may not be improper to say that the same success that has heretofore marked its existence has attended this valuable branch of the service during the past year. The marked improvement that has been noticed is mainly due to the experience of the past, with a careful study and application of the causes tending to produce the required results. The general effect of this has been to stimulate a higher regard for and greater confidence in the forecasts in this direction and a consequent increased demand for them.

The results in this direction have not been as extensive nor as satisfactory as should reasonably be expected, owing to the very meager and oftentimes insufficient appropriations at the disposal of the Chief Signal Officer, who is frequently compelled to deny the petitions of mariners, shippers, and others interested for increased service, because money has not been available for carrying them out as desired.

All available means have been adopted to increase the efficiency and usefulness of the wind-signal displays. This branch of the service has met with marked encouragement and assistance from the general public, and it continues to grow in popularity and in the estimation of those interested.

Four special display stations have been discontinued and four established during the year; the general display service has, however, been otherwise extended by increasing the number of regular stations displaying the signals, and also by the voluntary service of several interested citizens who give their services without compensation from the United States, and, in a few instances, furnishing all the outfit necessary for the display.

There are at present in operation, including both regular stations of the service, and the special or sub stations, on the Great Lakes, 53 stations; on the Atlantic coast, 54 stations; on the Pacific coast, 10 stations; and on the Gulf, 12 stations making a total of 129 stations of all classes displaying signals—an increase of 11 over the number in operation at the end of the last fiscal year.

Signals are displayed on the lakes only during the season of navigation. This year they were discontinued on December 5, 1890; they were resumed on April 16, 1891, except on Lake Superior, where the season opened May 1, 1891.

COTTON-REGION SERVICE.

No important changes in this branch of the service have been made since last report, the system then in vogue proving satisfactory, the appropriations not admitting an extension of its operations.

The same number of district centers (12) and special cotton-region stations (115) have been in operation during the past year that existed the year previous.

OBSERVATIONS OF TEMPERATURE OF WATER.

The observations of the temperature of the water were continued at the following stations up to November, 1890, when, by agreement with the Fish Commission, they were discontinued:

Stations.	Observations began.	Stations.	Observations began.
Boston, Mass	May, 1881	Key West, Fla	June, 1874
Fort Canby, Wash	Nov., 1883	New London, Conn	Apr., 1874
Charleston, S. C	Apr., 1874	New York City	Dec., 1873
Eastport, Me	May, 1874	Pensacola, Fla	Apr., 1881
Galveston, Tex	Dec., 1873	Portland, Oregon	May, 1881

INSTRUCTION OF ASSISTANT OBSERVERS.

Owing to the impending transfer of the weather service to the Agricultural Department, enlistments for the meteorological branch ceased in September, 1890 and, in consequence, the number of men under instruction has rapidly decreased since that date. There have been 27 men under instruction during the year. By April 1, 1891, all but 7 had been reported as having finished their course as assistant observers and become proficient in their duties.

During the last half of the year the instruction has been mostly confined to studies closely allied to meteorological duties and the instructions to observers, as amended from time to time; duties pertaining purely to the military service having been, to a certain extent, passed over.

On June 1, there still being 12 second-class privates under instruction, or of less than one year's service, the observers in charge of their respective stations were called on for special report as to the general knowledge and proficiency in station work of each of these men, with a view to recommending their promotion to the grade of first-class privates. All were subsequently reported as qualified and promoted accordingly.

LOCAL FORECASTS.

The success attained at the stations making local forecasts has been gratifying. During the year 45 observers have been authorized to make such forecasts of weather and temperature. Numerous applications have been received for authority to include forecasts of wind and river stages, and several observers have asked permission to make local forecasts for forty-eight hours instead of for twenty-four, as now, while one desired to make them for the entire State. Notwithstanding the fact that all of the applicants were probably well qualified, it was decided best not to extend the scope of this feature of the service until the present plan of making weather and temperature forecasts had been given sufficiently thorough trial to carry it beyond the tentative stage.

The officer in charge at Chicago was authorized to include the direction and velocity of wind in his local forecasts, but upon his being relieved from that station this element was omitted, so that forecasts of weather and temperature only are made.

The officer in charge at San Francisco has, as heretofore, continued to make forecasts for the Pacific coast region.

At stations where the receipt of the official forecasts would delay the maps beyond the regular time of issue, authority has been given the observers to substitute the local forecasts on such maps as were intended for distribution at the place of issue, or in the immediate vicinity.

FROST WARNINGS.

The season of 1890 in cranberry and tobacco districts was so favorable for the safe harvesting of these crops before the occurrence of killing frosts that the warnings, when received, were of comparatively little value to the interests affected, and for this reason alone many adverse reports were received as to the usefulness of frost warnings in the districts named above. In the cranberry districts the observers at Boston, Mass., Milwaukee, Wis., and Philadelphia, Pa., are supplied with frost warnings during the season (May 1 to November 1 of each year) for distribution to authorized points; in tobacco districts the warnings were sent (from September 1 to November 1) from this office to the following stations for the same purpose: Hartford, Conn.; New Haven, Conn.; Palmer, Mass.; Springfield, Mass.; Elmira, N. Y.; New York, N.Y.; Philadelphia, Pa.; Harrisburg, Pa.; Lancaster, Pa.; York, Pa.; Wilmington, Del.; Lynchburg, Va.; Richmond, Va.; Raleigh, N. C.; Cincinnati, Ohio; Lexington, Ky.; Louisville, Ky.; Nashville, Tenn.; Memphis, Tenn.; Kansas City, Mo.; St. Louis, Mo.; and Madison, Wis.; while a limited number of points in Maryland and Ohio (on the Baltimore and Ohio Railroad) have been furnished with the warnings direct from the Washington City office; in sugar districts, from October 1 to April 1, the observer at New Orleans, La., was furnished with such warnings for distribution; the fruit and vegetable districts were supplied with frost warnings through the observers at Chattanooga, Tenn. (September 15 to May 1); Charleston, S. C. (October 15 to April 15); Jacksonville, Fla. (November to March inclusive); and Mr. David Risley, Georgetown, S. C. (October 1 to April 1). Special warnings were also sent from September 1 to November 1, to Auburn, Ala. (for Alabama), and to the secretary of the New Orleans Cotton Exchange, New Orleans, La. (when frosts are predicted for any portion of the cotton region).

The following extracts from reports of observers in charge at distributing centers show that the warnings are considered valuable in a majority of districts and should be continued during the coming season:

[Boston, Mass. (219 Obs., 1891).]

Postmaster South Yarmouth, Mass.: "The warnings are of considerable value to the cranberry growers, and several have saved their crops, being harvested this fall, but I am unable to give any figure values. The growers are anxious to have them continued another year."

Operator, Barnstable, Mass.: "The frost warnings were received here. Think they would be of benefit to the cranberry-grower. But the last year, 1890, they were received after the crops were in, or most in.

Operator, Plymouth, Mass.: "We had no frosts the past season of any account until the cranberry season was over. Most of the large cranberry bogs are 5 or 6 miles from this office, and the owners say they are too far away to derive much benefit from the warnings. There are one or two nearer who have started bogs, and say next season they shall look out for the warnings."

Observer, Vineyard Haven, Mass.: "They are deemed quite valuable in this vicinity and should be continued next season."

Operator, Hyannis, Mass.: "One of our cranberry-shippers suggests flag and staff be provided for the warnings. He says that they will then be of more benefit to the growers if this is done. We post the warnings in the post-office, but the bogs are remote from the village, so they are not seen by many of the growers.

"The past season was an unusually favorable one for harvesting the cranberry crop, and the weather was good and frost late. The reports herewith are mostly conflicting with those heretofore received (the adverse ones), and I am disposed to account for the same by the favorable weather and consequently less attention to the frost warnings."

[Wilmington, N. C. (4,999 Sig., 1891).]

E. Porter, M. D., Rocky Point, N. C., says: "Frost warnings have been received regularly during the past season as in former years, and have saved our truckers and berry-growers thousands of dollars by enabling them to wrap up and otherwise protect those crops, which are of increasing importance to the farmers of eastern North Carolina. Our berry-growers and truckers fully appreciate your valuable information."

[Cincinnati, Ohio (310 Obs., 1891).]

* * * "No tobacco was saved by the warnings the past season, nor could there have been, for the reason that the tobacco was cut before the warnings came. They (the growers) admit that, owing to wide-spread conviction that frost would come early last season, a great part of the tobacco crop was prematurely cut, resulting in an inferior quality and in some cases stem rot in the shed;

whereas if they had had the confidence to leave their crop growing until a frost warning came, the tobacco would have ripened; would have been a far better quality and hence more valuable. This coincides with statements of leading tobacco men here, reported in my letter of October 18, 1890, *i. e.*, that 'much tobacco has been cut too green this season owing to a panic among farmers in regard to early frost which did not occur.'"

Dr. J. F. Scott, Williamstown, Ky., is of the opinion that the warnings are not of benefit, as the farmers, as a rule, do not see them, or if they do, do not understand them, or else disregard them and become panicky and rush to cutting at every cold wave. "Last fall, early in September, there came a cool wave, and the farmers instead of consulting the warnings, became alarmed at the prospect of frost and cut a large per cent of the growing tobacco crop, thereby very materially injuring it by cutting green."

Mr. H. N. Garnett, Cynthiana, Ky., speaks favorably, as follows: "The frost warnings are certainly of great value to the tobacco growers of this section. Our cutting begins about the last week in August, and ends by the middle of October, the bulk of the crop being cut usually from September 20 to October 1. During the late fall we who could get news from the town depended on the Signal Service reports to govern our cutting to a more or less extent, and profited by the frost warnings on at least two occasions."

Mr. J. I. Frazee, Maysville, Ky., writes: "I know of no instance during the past season where tobacco-growers were benefited by telegraph warnings of frost, for the reason that the crop was harvested some time before we had any frost. I can realize that frost warnings would be of great benefit to the grower where his crop is not harvested before the frost comes, one day's warning given enabling him to save quite an amount of tobacco."

Mr. J. J. Gish, Rittman, Ohio, thinks the warnings a good thing for tobacco-growers, and they should not be discontinued. He writes: "I can not now recall when first frost, to do any damage to anything, came, but think it was about the 20th of October; it was unusually late. We have, earlier, been badly caught by frosts, sometimes as early as the 20th of September. If we then could have had the benefits of the frost warnings much of the crops could have been saved."

Mr. L. F. Dohrmann, Greenville, Ohio, writes: "The Service warnings are of great value, and are so estimated by the tobacco-growers of the district. The alacrity displayed by many in housing their crops when rumors reach them through this medium of near approaching frost confirms me in this belief."

Mr. P. S. Dudley, Flemingsburg, Ky., writes: "But few reports have ever been sent here, and they as a rule have come too late (3 or 4 p. m.) to be of much service in saving outstanding crops. Three or four million pounds of tobacco are grown in this county. The cutting season is from September 1 to October 10. It is during this time that warnings would be of greatest benefit." * * *

[Harrisburg, Pa. (5,290 Obs., 1890).]

[Extract from letter written by Mr. F. R. Diffendeiffer, Lancaster, Pa., to the observer at Harrisburg, Pa.]

* * * "It is not easy to say how much benefit was derived by farmers from these reports. Farmers do not visit the city post-office in large numbers, nor the telegraph offices throughout the county. I infer that as a rule farmers see these frost warnings but seldom in time to do them much good. At the same time I have no doubt they are seen by some and may be in time to permit farmers to take advantage of them.

"The crop most commonly caught by frosts is tobacco. Luckily no damage was sustained from this cause this year. If the necessary warnings could be got to farmers early in the day they might be of considerable benefit, but I do not believe that this has been accomplished by the present system." * * *

[Louisville, Ky. (186 Obs., 1891).]

* * * "The lateness of the first frost and the peculiar temperature conditions of the fall of 1890 are exceptional, and are by no means to be accepted as a basis for the estimation of the usual value of the frost warnings. The early killing frost of the preceding year and the ample notification of its approach demonstrated fully what vast benefit may result from a timely warning. As evidence of this fact may be cited the statement of a prominent resident of Shelbyville, Ky., who says that in Shelby County alone, where the facilities for the distribution of the warnings are exceptionally good, the value of tobacco saved from

partial or total injury by the warning referred to was at least $100,000. There is good reason to believe that in other counties similar if not greater results were accomplished.

"At the commencement of the past season the frost-warning system was much more thoroughly organized and efficient than at any previous time. Many of the displaymen devised ingenious methods for the distribution of the warnings throughout their respective vicinities. Flags carried on coaches traversing the country, the blowing of preconcerted signals from steam whistles, special messengers, and the telephone, where the facilities for its use existed, are among the means employed to disseminate the information.

"The Louisville Tobacco Board of Trade has contributed very largely to the success of the system by the subscription of funds for the purchase of flags and the suggestion of names of reliable displaymen. During the coming year every effort will be made to still further extend it. Its success in the past fully warrants all endeavors tending towards its improvement."

[Memphis, Tenn. (502 Obs., 1891).]

* * * "Several postmasters at places where the tobacco crop is cultivated have suggested that the warnings be sent to them, as they were in a position to give the widest possible distribution to the information, and if a system of frost warnings is contemplated for this section for the coming season, I respectfully suggest that plan be followed, if found practicable; also that the warnings be furnished only to places where satisfactory evidence of a very general interest in the service can be obtained."

[Nashville, Tenn. (146 Obs., 1891).]

* * * "In the tobacco districts of this State the crops will aggregate many millions of dollars, and as the warnings are sent so as to reach nearly every section I am confident that the money saved during the past season will count up into the hundreds of thousands.

"During the past season the warnings were sent out in time to be taken advantage of, and I have been told by several parties who only had small fields of it that they lost none worth mentioning: whereas if they had received no warning of an approaching frost their entire crop, amounting, in one instance, to $600, would have been lost. I feel confident that there are many other such examples throughout the State if their views could be obtained. The number of persons to whom the warnings are to be sent have been so increased during the latter part of the season that they will be even more beneficial during next season than they were this."

[New York, N.Y. (320 Obs., 1891).]

* * * "Upon personal inquiry, and, in so far as the observer is able to judge, the warnings were found to be particularly useful to the vegetable growers in the neighboring towns of New York City on Long Island during the past season. Gardeners spoke of them in the highest terms."

[New Haven, Conn. (311-970 Obs., 1891).]

* * * "Mr. E. P. Wilcox, Meriden, Conn., advises the continuance of the warnings, as it would stimulate the grower to hire an extra force of labor and save his crop." * * *

Mr. William N. Clapp, East Hampton, Mass., says that he enjoys the reports from the Signal Office, and wishes to encourage them to continue their labors and investigations, which will be of great benefit to the farmer and the whole community. He says that his town is troubled with early frosts only once in every six years. He endeavors to house his crop before the arrival of frost.

"The warnings in some of the towns are supposed to be for the benefit of the cranberry-growers also, and are used by all growers of late vegetables." * * *

Mr. E. L. Goodyear, postmaster at North Haven, Conn., writes to the Observer at New Haven, Conn., as follows: * * * "The gardening interest has increased and taken the place of tobacco, and I find the reports from the Signal Office are of very great value to them; one gardener lost $500 by early frost three years ago; much may have been saved by observing the signal reports; others lost still larger amounts. I find the farmers generally take an interest in the weather reports and can hardly get along without them; there can be no question in regard to the great benefit conferred by this service. I hope the time may come when every post-office will receive the report and have it placed where all can have the benefit of the service who come to the office. It is of great benefit to brick-makers, as it enables them to prepare for storms and saves them from great loss. Can't do without it." * * *

[St. Louis, Mo. (282 Obs., 1891).]

* * * "The leading purchasers of raw tobacco, and manufacturers, in this city have been interviewed, from whom it has been ascertained that the production of tobacco in this State has greatly declined during the last three or four years. * * *

"It has been suggested by some of these gentlemen that probably greater benefits would be derived from warnings if they were addressed to individuals throughout the State who are personally interested in the industry, and who would agree to bulletin and otherwise publish the warning as extensively and as quickly as possible." * * *

The subject of frost warnings and the mode of their distribution have been thoroughly investigated since the close of the last tobacco and cranberry season, and it is deemed that there is much in the present system that is susceptible of improvement in order that greater benefits may accrue from the warnings sent out from this office, and at a far less expenditure from the telegraphic appropriation. It appears that the system has not, in the past few years, been given the time and attention necessary to maintain in successful operation so important a branch of the work of the Signal Service, and, in many instances, the distribution of the warnings having been in the hands of persons in no wise connected with the Signal Service or responsible for the correct performance of their labors, this office has had no check on their work, therefore no direct voucher to indicate whether or not the telegraph service has been rendered. In fact, very many replies received to a letter sent out on December 20, 1890, to stations authorized to receive warnings, show that no such telegrams had been received during the past season, and in some instances had never been received. In very many other cases (over 70 per cent, as indicated by the answers to the above-mentioned letter) the recipients of warnings stated that no interests were benefited and the interest manifested in the reports was not sufficient to warrant their resumption next season. In this connection, however, it should be borne in mind that the past season was exceptional so far as it related to the early occurrence of killing frosts, and the crops had mostly been harvested before the receipt of the first warning. Still, with a proper consideration of this fact, it would appear that the warnings were not fully appreciated by those having interests affected. It is also obvious that the plan of sending the warnings to the railroad operators to be bulletined by them in their offices or the depot waiting rooms for the benefit of the public is not a good one, as, in a majority of cases, the points to which the telegrams have been sent are isolated railroad stations at which very few people ever congregate, and the fact of a receipt of a frost warning is seldom known to the persons to be most benefited thereby, as no effort is made towards its dissemination, the agent or operator considering his duty accomplished when the message is received by wire and posted on his office door.

The remedy for this suggests itself as follows: To correspond with the postmasters at such places as have tobacco or cranberry interests; furnish them with printed circulars relative to frost warnings, explaining the benefits to be derived therefrom, and giving a complete description of the cold-wave or frost-warning signal, and request them to distribute the circulars among tobacco and cranberry growers, and at the same time authorize the statement that, if a flag, which will be furnished by the weather bureau, is properly displayed by any one of their number for the benefit of all, the official frost warnings will be telegraphed to the address of the designated person at Government expense. The stations authorized should be grouped in sections and placed under distributing centers at which observers of the weather bureau are on duty, as is now done in the distribution of forecasts for the display of weather signals, and such observers be given explicit instructions relative to forwarding the warnings at the earliest moment after their receipt from this office; or, if arrangements are made for the preparation of forecasts of frost by local observers at selected stations, to provide for their distribution to designated points in the same manner. By this plan the whole system could be perfectly operated, a check be kept on all expenditures, the warnings be placed in the hands of a responsible party having personal interest in the matter, and a warning signal displayed for the benefit of all concerned.

RAILWAY BULLETIN SERVICE.

The following-named railroads are now coöperating with the Signal Service, by distributing the weather forecasts, or cold-wave warnings (which are received by telegraph either direct from Washington City, or through the various distributing centers) to designated stations, daily, at which they are bulletined for the benefit of their employés and the general public, forms for the purpose having been supplied from this office:

Railroads.	Stations.
Allegheny Valley	38
Atchison, Topeka and Santa Fé	91
Baltimore and Ohio	67
Baltimore and Ohio Southwestern	31
Baltimore and Potomac	3
Central Railroad of New Jersey	39
Chicago and Iowa	23
Cleveland, Cincinnati, Chicago and St. Louis (Cairo Division)	2
Cresson and Clearfield	4
Cumberland Valley	10
Detroit, Grand Haven and Milwaukee	5
Detroit, Lansing and Northern	25
Grand Rapids and Indiana	62
Grand Trunk	14
Huntingdon and Broad Top Mountain	8
Lehigh Valley	32
Louisville and Nashville	21
Louisville and St. Louis Air Line	28
Louisville, New Orleans and Texas	43
Mobile and Ohio	4
New York, Philadelphia and Norfolk	19
Northeastern	8
Northern Central	30
Ohio and Mississippi	28
Ohio River	25
Old Colony	144
Pennsylvania (Pennsylvania R. R. Division)	76
Pennsylvania (Philadelphia and Erie R. R. Division)	35
Pennsylvania (United Railroads of New Jersey Division)	36
Peoria, Decatur and Evansville	33
Philadelphia and Reading	118
Philadelphia, Wilmington and Baltimore (Maryland Division)	21
Rock Island and Peoria	22
St. Louis, Alton and Springfield	13
St. Louis, Arkansas and Texas	5
South Carolina	19
Terre Haute and Peoria	27
Toledo, Peoria and Western	41
Washington, Ohio and Western	7
Western Maryland	28
West Jersey	57

WEATHER SIGNALS.

The distribution of forecasts for the display of weather signals is still continued, and the great interest in this mode of disseminating weather information remains unchanged, a very great number of the older display stations being still in operation, while a large number of new stations have been established, demonstrating fully that the signals meet with popular favor and more than fulfill the service for which the displays were inaugurated. The total number of stations now receiving forecasts or cold-wave or frost warnings at Government expense is 878; 321 having been established during the fiscal year and 249 discontinued. The geographic distribution of such stations according to States and Territories is shown in the following table:

States and Territories.	Established.	Discontinued.	Now in operation.
Alabama	1	2	6
Arkansas	1	2	12
California	36	14	20
Colorado	1	2	3
Connecticut	1	0	3
Delaware	1	0	3
Florida	7	3	19
Georgia	3	3	9
Illinois	8	5	44
Indiana	10	15	49
Indian Territory	0	0	1
Iowa	16	16	60
Kansas	8	15	35
Kentucky	0	3	15
Louisiana	0	2	34
Maine	8	2	10
Maryland	0	0	2
Massachusetts	0	3	11
Michigan	49	33	75
Minnesota	1	1	20
Mississippi	6	4	24
Missouri	10	15	44
Montana	0	0	1
Nebraska	10	16	27
Nevada	4	4	0
New Hampshire	0	2	3
New Jersey	7	3	16
New Mexico	0	0	1
New York	13	15	48
North Carolina	4	5	26
North Dakota	0	5	4
Ohio	12	10	42
Oklahoma	3	0	3
Oregon	9	0	10
Pennsylvania	11	12	41
South Carolina	4	7	23
South Dakota	6	7	11
Tennessee	1	4	11
Texas	10	6	25
Vermont	2	2	5
Virginia	6	3	19
Washington	4	1	4
West Virginia	2	1	5
Wisconsin	46	6	52
Wyoming	0	0	2

The use of steam-whistle signals for the distribution of forecasts of weather and temperature appears to be gaining favor in many sections, owing in a measure, it is believed, to the fact that good service can be rendered with a minimum amount of expense, the necessary outlay for signal flags being avoided. This latter item alone is not inconsiderable, and in a great number of cases the forecasts have been discontinued because the recipients of telegrams could not afford to procure an additional set of flags and comply with the conditions under which the predictions were furnished at Government expense. A modified code of whistle signals is submitted, which it is thought will answer all purposes in this direction.

WHISTLE SIGNALS.

(NOTE.—The warning signal, to attract attention, will be a long blast of from fifteen to twenty seconds duration. After this warning signal has been sounded, long blasts (of from four to six seconds duration) refer to weather, and short blasts (of from one to three seconds duration) refer to temperature; those for weather to be sounded first.)

Blasts.	Indicate.	Blasts.	Indicate.
One long	Fair weather.	One short	Lower temperature.
Two long	Rain or snow.	Two short	Higher temperature.
Three long	Severe local storm or tornado.	Three short	Cold wave.

The foregoing code will admit of combinations covering nearly every prediction relating to weather and temperature sent out from this office, and by repeating each combination a few times, with an interval of ten seconds between, possibilities of error in reading the forecasts will be avoided, such as may arise from variable winds or failure to hear the warning signal.

These whistle signals may be utilized to better advantage in many places where flags could not be seen at long distances, due notification being given to the surrounding community that at a designated hour the steam whistle at a certain place will sound the signal to indicate the probable weather and temperature for the ensuing twenty-four hours.

On November 1, 1890, the distribution of forecasts and warnings to display stations in southern Mississippi was placed under the supervision of the observer at New Orleans, La., as better telegraphic communication from that point was assured for that section than furnished from Memphis, Tenn.

In accordance with recommendations of the State weather service observer at Raleigh, N. C., the distribution of forecasts and warnings for North Carolina and southern Virginia was on December 1, 1890, placed under the supervision of the observer at that station, instead of the observer at Charlotte, N. C.

On December 1, 1890, by the orders of the Chief Signal Officer, the special rate on weather-signal messages was abolished, since which date such messages have been transmitted from distributing centers under the regular Government rate established by the Postmaster-General. The change has been attended with good results, as under the Government rate the messages are delivered, and much annoyance and serious delay in the receipt of telegrams is avoided.

WEATHER MAPS.

The issue of weather maps has steadily increased at all of the map-publishing stations, except at St. Louis and Kansas City. By reason of unfavorable changes in the mail schedules, which prevented the maps from reaching their destinations until twenty-four or more hours after their issue, 87 maps were discontinued at St. Louis and 142 at Kansas City. The publication of maps has been commenced during the year at eleven stations, viz: Cairo, Davenport, Duluth (during navigation only), Huron, Little Rock, Meridian, Miss. (from March 1 to November 30 only), Minneapolis, New Haven, San Francisco, Shreveport (from April 1 to October 31), and Tampa (from November 1 to March 31), at all of which morning maps are issued. The total number of stations now publishing maps is 51, of which 42 issue a. m. maps, 3 issue p. m. maps, and 6 issue both a. m. and p. m. maps.

At Boston, Kansas City, New York City, and St. Louis the printing presses have been discontinued, and the maps are now prepared entirely by the milliograph process. The "rule and figure" data, formerly printed, is now placed on the maps by means of type-written stencils. The change has been attended with a marked degree of success both in time and labor, the general appearance of the maps being very good. It is thought that the same course might be pursued with advantage at the other printing station (Cincinnati).

The Chief Signal Officer ordered that certain stations show graphically on their maps, by means of dotted and broken lines, changes in temperature and excessive rainfalls. After this system had been inaugurated, Sergt. L. M. Dey, in charge of the Philadelphia station, devised a shading apparatus for displaying these conditions by using colored inks in connection with a set of corrugated rollers. Fifteen of these machines have been put in use at the larger stations.

The stations issuing maps were directed, on May 28, 1891, to carefully consider and consult local interests as to what information would be most acceptable and of the greatest benefit to their respective localities, and to submit a map containing the data best adapted, in the opinions of all interested, to the local necessities, the maps to be prepared in duplicate and forwarded as soon as possible. When the maps were received they were carefully examined, and one of them, as approved by the Chief Signal Officer, was returned to the station to be filed as a sample for use in issuing future maps. A copy from each station was also filed at this office for reference.

Since the inauguration of the milliograph duplicating process the observers on duty at the stations publishing weather maps have improved in their work to a commendable degree, quite a number becoming expert map-makers. The policy has recently been adopted of specially commending by letter each month the five observers who have excelled in the character of their map work during the preceding month.

The policy of the Chief Signal Officer, inaugurated last fiscal year, of replacing the "cyclostyles" by "milliographs" has been carried out this year until all map stations are using that most useful apparatus, and the saving to the service, both in price of paper and machines, has been great, while the general appearance of the maps issued at the stations, taken as a whole, is so far superior as to exceed the most sanguine expectations: in addition much valuable time is saved in running off the maps.

The following stations are now issuing maps:

Atlanta.	Harrisburg.	Norfolk.
Augusta.	Huron.	Pittsburg.
Boston.	Indianapolis.	Pensacola.
Buffalo.	Jacksonville.	Portland, Me.
Cairo.	Kansas City.	Philadelphia.
Chattanooga.	Knoxville.	St. Louis.
Chicago.	Little Rock.	St. Paul.
Cincinnati.	Louisville.	Sandusky.
Columbus.	Manistee.	San Francisco.
Cleveland.	Memphis.	Savannah.
Davenport.	Meridian.	Shreveport.
Denver.	Milwaukee.	Sioux City.
Detroit.	Minneapolis.	Springfield, Ill.
Des Moines.	Nashville.	Tampa.
Duluth.	New Haven.	Toledo.
Erie.	New Orleans.	Vicksburg.
Galveston.	New York City.	Wilmington.

The following condensed rules governing the distribution of weather maps, and action to be taken upon applications for the same, have been issued to all map-printing stations, being the result of a careful consideration of the subject:

"Observers in charge of map stations are vested with authority to issue weather maps to—

"Business men or firms, who agree to prominently display the maps in front of their places of business, or in some place easily accessible to the general public, the desirability of the location being left to the discretion of the observer.

"Commercial bodies, boards of trade, educational institutions (always ascertaining and reporting the dates of beginning and ending of the school year), railroad depots, wharves, ferries, etc., in the city where the maps are published.

"Postmasters at outlying towns and villages, desiring to post the maps for the benefit of their patrons, whose offices can be reached with the a. m. edition not latter than 2 p. m. of the day of issue, or with the p. m. edition by 9 a. m. of the day following.

"In all of the above cases, when maps are furnished, observers will immediately report their action to this office for approval, and when frames are required for the proper display of the maps, the fact should be stated.

"In all other cases observers will refer applications to this office, for consideration and authorization.

"In forwarding requests from applicants at a distance observers will invariably report in their indorsements the time at which maps will reach their proposed destinations."

On December 13, 1890, observers at map stations were called upon for report as to mail schedules at their respective stations. Upon the receipt of these reports the lists were carefully revised in accordance with the foregoing rules, as to the time of receipt, all places that could not be reached within the prescribed time being dropped from the observers' lists, except in special cases.

The following table shows a number of the stations now issuing a. m. maps, the approximate number of mail routes at same during the daytime, and the number that can be utilized for sending the maps:

Stations.	Routes.	Available for carrying a. m. maps.
Cleveland	8	1
Des Moines	8	2
Galveston	2	0
Indianapolis	9	1
Louisville	8	1
Memphis	10	0
New Orleans	8	0
San Francisco	12	0
Meridian	3	0
Total	68	5

Night maps could be issued at these places to advantage if the appropriation for telegraphic service would admit of sending them the necessary reports.

Special requests have been received from the observers at Meridian, Miss., and Galveston, Tex., for authority to issue p. m. maps on account of the urgent requests from places within 100 miles, but owing to the lack of funds for telegraphing the reports favorable action could not be taken. Night maps, leaving in mails at 2 or 3 a. m., could be supplied before 9 a. m. to places 150 miles distant from the station.

The total present issue of maps at all of the stations amounts to a daily average of about 3,100 copies. The yearly issues since the commencement of their publication are as follows:

Fiscal year—	
1886-'87	178,248
1887-'88	392,161
1888-'89	859,000
1889-'90	1,069,534
1890-'91	1,199,002

Of which last number 191,846 were issued from this office.

Evidence that this form of signal service publication is eagerly sought and carefully studied for the benefits to be obtained by business interests and the general public comes from many quarters, and in consequence the maps have become popular in the communities in which issued to an unprecedented degree. In a number of instances business firms have used the data furnished thereon as a check on reports of nonperformance of work by traveling salesmen and others on account of rain on specified dates. It is thought that this interest would be greatly increased by permanently posting with each map frame a printed card giving a full explanation of the maps and the information contained thereon. A board about 6 by 10 inches in size could be fastened immediately above the frame and the card attached.

WEATHER REPORTS FROM THE WEST INDIES.

The new project of obtaining reports from stations in the West Indies by the coöperation of the United States consuls, which was under consideration last fiscal year, was successfully put in force early in the present year. Through the courtesy of the Department of State the Chief Signal Officer perfected arrangements for the establishment of auxiliary stations at St. Thomas, San Domingo, Kingston, and Santiago de Cuba.

The observers were appointed in each case upon the recommendation of the United States consuls.

Two observations are taken daily at specified times, and in case of marked atmospheric changes a special observation is at once taken and telegraphed. For economic reasons but one such special report will be paid for daily: The period of observations is from July 15 to October 15, or during the hurricane season. The messages are sent to the observer, Key West, Fla., by a code similar to the following:

(1) Address: "Observer, Key West."

(2) Time of report: "Morning," "night," or "special."

(3) Reading of barometer (to inches and hundredths): A barometer reading of 30.25, 29.25, or 28.25 would be entered in the telegram as "thirty twenty-five," "nine twenty-five," or "eight twenty-five."

(4) The direction of wind: The direction from which the wind is blowing to be taken from the eight points of the compass, as indicated in the following scale:

N.	NE.	E.	SE.	S.	SW.	W.
NNE. N.	ENE. NE.	ESE. E.	SSE. SE.	SSW. S.	WSW. SW.	WNW. W.
NW.	CALM.					
NNW. NW.						

(5) Force of wind and velocity: Wind velocity to be taken from the following scale: Calm, light, moderate, brisk, high, gale, or hurricane. (See Hazen's tables, page 81.)

(6) State of weather: The state of weather to be taken from the following scale: (1) Clear; (2) partly cloudy; (3) cloudy; (4) threatening; (5) sultry; (6) showery; (7) light rain; (8) heavy rain.

From the above code the following dispatch is made up as an example:

"ST. THOMAS, *August 31, 1890, p. m.*

"OBSERVER, *Key West.*

"Night; nine sixty-five; northeast; high; threatening.

SMITH."

The observers are paid 75 cents for each regular observation, provided the telegrams are filed at the times designated, and 50 cents for each special observation.

All the stations, except San Domingo, began reporting during the month of August, but reports from that point were not received until the latter part of September, owing to the delay in the receipt of instruments, also in making arrangements with the French Cable Company for the transmission of messages at half rates.

These reports from the West Indies are telegraphed by special message to the observer at Key West, Fla., who enciphers them in the code used by this service, combines them in one special message and telegraphs them to the observer at Jacksonville, Fla., at which point they are placed on the Washington and Jacksonville circuit and come into the central office. The special observations are telegraphed to the observer at Key West, Fla., and at once transmitted by him to the Washington office.

By special arrangement with the observers at the West Indies stations, cablegrams, at the expense of this service, are also sent at the approach of hurricanes from October 15 to July 15, for which service the observers are paid $1 for each cablegram.

REPORTS FROM BERMUDA ISLAND.

Correspondence was had with Prof. Carpmael, of the Canadian meteorological service, with a view to receiving reports from Bermuda Island, through the Toronto office, but owing to a contest between that service and the Halifax Cable Company, as to the rates to be paid, no arrangements have been perfected. This service, however, receives, at such times as unusual meteorological conditions obtain, the Bermuda reports direct from the island at the expense of the United States, through the courteous attention of Gen. Russell Hastings, who voluntarily performs this scientific work for the Signal Office.

REPORTS FROM HAVANA.

Through the courtesy of Prof. Carbonelly, director maritime meteorological office, Havana, Cuba, daily reports have been received regularly throughout the year from Havana.

Mail reports from Grindstone Island, Canada, have been received quite regularly since its establishment in October, 1890, through the Canadian meteorological service, Toronto, Canada.

The stations at Mount Killington, Vt., and Mount Washington, N. H., were reopened for the season June 15, 1891, and orders issued reopening that at Green Mountain, Mount Desert, Me., on July 1, 1891.

These stations are maintained during the summer months, principally to furnish meteorological information to the traveling public and in the interests of the large number of people who visit these places during the summer season.

The observations taken are compiled and the data used in determining the climatological conditions of that section.

OFFICES.

The offices of the service throughout the country have been generally placed in a very creditable condition, old furniture having been repaired or, when necessary, condemned and new articles supplied, until at present those offices located in towns and cities are quite neatly and comfortably furnished.

COÖPERATION WITH THE HYDROGRAPHIC OFFICE.

During the past year the observers in charge of the stations at Brownsville, Charleston, Eastport, Galveston, Key West, Mobile, New London, Pensacola, San Diego, Southport, and Wilmington have continued to perform such work for the Hydrographic Office as could be done without interfering with their regular station duties. The average time during the month devoted to the work of examining logs of vessels, making extracts therefrom, comparing barometers, etc., has been about nine hours for each station.

TYPEWRITING MACHINES.

During the year twenty additional stations have been supplied with typewriters, which have proved of great value in carrying on the correspondence as well as in writing stencils for circular letters, and entering the rainfall and river data, also the synopsis and forecasts on the maps. This latter work has, in many instances, been nearly equal to print, and in all cases much more legible than that produced from autograph written stencils.

THE WASHINGTON STATION.

The Washington station of observation is still in the cupola originally occupied, and the location is satisfactory. The self-recording instruments belonging to the instrument division and the observer's room is now in a presentable shape.

Observations with the sunshine recorder have been continued throughout the year, but do not give a satisfactory record, owing to the quality of the prepared paper used in the instrument. Further experiments will be necessary to determine the kind of paper best adapted for the purpose. The sunshine recorder in use up to February 6 was turned in on that date and replaced by a new pattern recorder.

No other changes have been made in the regular instruments of the station.

The monthly record sheets made by the thermograph in the station instrument shelter are kept and filed by the observer, and also those from the barograph now in the instrument room.

The battery case was received several months ago, and a triple self-register is expected in a short time, when the station will be completely equipped with self-recording instruments.

The office room needs painting and the woodwork varnishing; the floor should be covered with either carpet or matting. The room is poorly heated, and a steam heater should be put in before the winter season.

On June 13 the Washington station, with the three meteorological observers on duty in connection therewith, were transferred to the forecasts division.

Respectfully submitted.

JAS. MITCHELL,
Second Lieutenant, Fifteenth Infantry, Executive Officer.

The CHIEF SIGNAL OFFICER, U. S. ARMY.

APPENDIX 8.

ANNUAL REPORT OF DATA DIVISION.

SIGNAL OFFICE, WAR DEPARTENT,
Washington City, June 30, 1891.

SIR: I have the honor to submit herewith, in duplicate, the annual report of the data division for the fiscal year ending June 30, 1891.

RECORDS RECEIVED.

There have been received during the year from all sources meteorological forms and reports of a statistical nature, as shown in the following table:

NUMBER OF FORMS AND REPORTS RECEIVED FROM SIGNAL SERVICE, VOLUNTARY, AND POST HOSPITAL STATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1891.

No. of form.	Designation.	Reports received.
1001	Original record of observations	1,736
1002	Annual meteorological summary	145
1003	Annual meteorological summary (abridged)	290
1004	Monthly meteorological record of third order and rainfall stations	1,060
1005	Monthly meteorological record of cotton-region stations	1,153
1006	Monthly meteorological record of river stations	1,332
1008, 1009	Voluntary observers' and army surgeons' reports	9,384
1014	Abstract of daily journal	2,072
1015	Record of self-registering rain gauge	1,440
1015	Anemometer record sheet	41,520
1016	Anemometer and anemoscope record sheet	1,320
1017	Anemometer, anemoscope, and rainfall record sheet	9,360
1022	Hourly wind movement	1,736
1026	Hygrometer readings	60
1026	Hourly barograph readings	540
1026	Hourly thermograph readings	716
1029	Annual report of stations	446
1031	Monthly record of wind signals	1,200
1032	Monthly record of cold-wave signals	1,524
1033	Monthly record of wind signals at special display stations	672
1061	Telegraphic cipher report of observations	104,160
1064	Record of radiation	98
1065	Sunshine record	240
1066	Report of verification of weather and temperature forecasts	1,032
	Baragraph trace	2,160
	Thermograph trace	2,864
	Total	188,260

Careful record has been made of the receipt of the more important forms, especially those from which the data for the Monthly Weather Review are drawn, and those of special rainfall, river, and cotton-region observers. Although an average of over fifteen thousand reports are received and distributed each month, but little labor is devoted to making a record of their receipt. During the first half of the month, when the receipts are quite heavy, all matter is checked and distributed by noon of each day. Little importance is generally attached to the mere routine of checking the receipt of monthly returns from a great body of observers, yet as indicating the industry and zeal of individual observers, especially those who do not communicate daily with the office by telegraph, it is a matter of considerable moment, and one which warrants close attention. The first evidence of growing carelessness in an observer manifests itself in his returns and in the time of mailing them. Experience has abundantly shown the necessity of naming a definite time for mailing the more important reports and of keeping an accurate record of their receipt at the central office.

Perhaps nothing will better illustrate the promptness and energy of the present corps of observers than the mere statement that but twenty-four cases of tardiness in forwarding monthly reports have occurred during the past year. That such a record should be made, in view of the limited time available for the preparation of these reports, and notwithstanding the fact than an unusual amount of sickness prevailed, attaining in some localities the character of an epidemic, is especially commendable, and speaks highly of the efficiency and zeal of the subordinate forces of the Bureau.

In the class of special observers—those making daily observations of rainfall, or rainfall and temperature combined, or stage of water in the river, the record for promptness is also high. This class of observers, without exception, it is believed, are engaged in other occupations, and can not be held to that degree of responsibility which attaches to a position solely given to conducting a regular station of the Signal Service. Out of a possible 2,650 reports, but 56, or 2 per cent, were tardy, and 33, or about 1 per cent, failed entirely of being received.

EXAMINATION OF METEOROLOGICAL REPORTS.

The examination of meteorological forms and reports made by Signal Service observers has continued with gratifying results. With but few exceptions the work of the observers has been most excellent; the high standing noted in last annual report has not only been maintained, but an improvement has been observed, which, in view of the additional labor imposed by the care and reduction of records pertaining to a first-class station, is especially commendable. The following table shows the number of entries and computations involved in the preparation of a year's reports at a station of the first class:

Reports.	Entries.	Computations.
Original record of observations	126,655	8,628
Annual summary of observations	10,200	291
Wind and rainfall records	15,480	2,442
Hourly barograph readings	29,016	10,200
Hourly thermograph readings	25,824	10,200
Hourly wind velocity	11,484	1,320
Cipher weather dispatches (words)	3,650	
Total	222,309	33,081
Average for month	18,527	2,757

(Stations of the second order differ from the above in not having barographs, thermographs, and self-registering wind and rainfall attachments.)

Thus it will be seen that at stations of the first and second classes the preparation of the monthly and annual reports involve the entry and verification of over eighteen thousand figures, and the calculation of nearly three thousand averages, departures, percentages, etc. The observer has, moreover, but a small amount of time at his disposal for the compilation of these reports. The original record of observations, in which the possibility of error is probably the greatest, must be dispatched on the second day of the month succeeding that for which it is a record; meanwhile the regular observations must be made, and the routine work of the station attended to. The observer is, of necessity, compelled to work extra hours during the first part of each month in order to get his reports in the mail at the required time. Notwithstanding these hindrances to accurate work, no less than thirty observers made under ten errors each during the six months ending December 31, 1890, the average per observer being 5.4 errors for the six months, less than an error per month. The average of the most proficient observers for the six months ending June 30, 1891, can not be determined at this writing, but it will be higher than the foregoing, inasmuch as the annual forms, falling in the last half of the year, naturally tend to make the number of errors found in that half of the year numerically greater than the first half.

Having given the record of the most proficient observers, it is but proper to call attention to the work of those who, in the period above quoted, fell below the standard of efficiency. Nine, or 6 per cent of the whole number of observers in charge of first and second class stations, made more than sixty and less than one hundred errors, the average being sixty-nine errors for the six months. Six of the above number are experienced observers. The remainder have had but little experience in the management of a station, and have since shown marked improvement in their work.

The record for the preceding six months, in regard to efficiency, differs but slightly from the figures given above, being 25, or 17 per cent, of the total number of observers in charge of first and second class stations, with an average of five errors each for the six months. Taking the corps of observers as a whole, the record for efficiency is highly creditable. The whole number of errors made by 311 observers during the year ending June 30, 1891, is 9,422, an average of thirty errors per man per annum, or two and one-half errors per month. Considering the very great number of entries and computations involved in a month's work, it is believed the percentage of accuracy attained, one error for each 7,411 entries, will compare most favorably with the efficiency of any other branch of the public service.

The table below shows the number of forms examined and error letters prepared during the year:

Forms No.—	Number examined.	Error letters written.
1001	1,736	
1015	52,560	1,736
1022	1,716	
1002	143	143
1003	143	
1026	1,256	960
1061	88,038	980
1065	240	200
1004	348	232
Total	146,183	4,251

METEOROLOGICAL DATA.

The application of meteorological data to the practical affairs of every-day life is well illustrated in this branch of the division's work. The tendency towards theoretical investigation, while fairly well marked, is but slightly felt as compared with the growing demand for information which is directly applicable to the varied interests of trade and commerce. The interests of parties in litigation, especially on the eastern seaboard, are served in no small degree by the presentation of climatological facts which tend to modify in a greater or less measure the liabilities of the parties in action. The number of requests for information as to the state of the weather at the entrance of Delaware and New York bays, respectively, suggest the advisability of making arrangements for a more complete record of the weather at these points. The records now made at Sandy Hook, N. J.—wind velocity only—have been used frequently, but in almost all cases the value of the information so obtained would have been greatly enhanced if the direction of the wind and the state of the weather could have been added. Applicants for information as to weather conditions at Delaware

Breakwater are given, as a rule, data for Atlantic City, N. J., but it is doubtful whether the latter are as satisfactory as might be desired.

The opening up to settlement of new territory in the Southwest has created a demand for climatic data pertaining to that region. Unfortunately the office has not been able to supply in all cases as much information, either in quality or quantity, as desired, owing to a scarcity of observations.

The experience of the year confirms the opinion before held that a climatology of the United States by States or localities, prepared under such conditions as would enable the ordinary mind to grasp the salient climatic features of each State or locality would be of very great value to the people. Such a work would tend to educate the masses in the methods of modern climatic research, and encourage habits of observation in those who have a natural inclination in that direction. The publications of the Weather Bureau available for distribution, so far as temperature and precipitation—the elements of most importance—are concerned, are now more comprehensive than ever before, but it is the exceptional mind which can take monthly averages, extremes, etc., as they are put forth in annual reports, the channel through which climatic data for many portions of the country must flow, and properly comprehend them.

The climatic reports already made pursuant to Congressional resolutions have proven highly beneficial, and it is hoped that some general provision may be made whereby the climate of all portions of the country may be similarly reported upon.

The following statement shows in detail the number of certificates, tables, and statements that have been furnished during the year:

Transcripts of Signal Service records authenticated by the honorable Secretary of War	74
Signal Service records produced in court by observers in charge of stations (number of times)	107
Miscellaneous tables and statements, not certified, furnished by this office	429
Miscellaneous tables and statements, not certified, furnished by observers	245
Total	855

REVIEW TABLES.

The meteorological tables which appear in the Monthly Weather Review have been prepared with that care and attention necessary to secure trustworthy and reliable data. Special attention has been given to the enlargement of the table of miscellaneous voluntary observers' reports, and to the publication of delayed reports. Thus the results of practically all of the observations contributing to the Bureau are put in convenient form for reference and study, not only by those connected with the Weather Bureau, but by students of meteorological data, wherever situated. The fund of information conveyed to the student of climatology through the medium of the Monthly Weather Review will best be comprehended by an examination of that publication.

FILING AND BINDING.

There remained to be bound on July 1, 1890, forms and reports for the year 1889 only. Since, however, the reports for several years can often be bound more economically than the forms for a single year, no action was taken to bind the 1889 reports until those for 1890 had accumulated.

There were bound during the year the following:

	Volumes.
Anemometer records:	
1889	151
1890	152
Abstracts of daily journal:	
1889	37
1890	36
Original records of observation, 1889	21
Observers' annual reports, 1889	2
Annual meteorological summary, 1889	1
Total number bound volumes	400

THE RECORDS VAULT.

No progress has been made during the year toward improving the old or providing new shelving for the accommodation of the records which have been accumulated during the past twenty-one years.

Attention is especially invited to the fact, pointed out in the records officer's previous report, that the present shelving is far from being adequate to the needs of the Bureau. Several tons of valuable records are now resting on the floor, all of which are slowly but steadily yielding to the inevitable forces of destruction.

It should also be remembered that with the transfer of the Weather Bureau to the Department of Agriculture the original records of observation now stored in the War Department building must be removed therefrom.

Every foot of wall shelving is now occupied, and in many sections the records are packed away in double tiers, making access to those in the rear quite laborious. Satisfactory storage facilities can not be had without substituting adjustable metal shelving for the temporary wooden wall shelving and constructing new interior shelving, as recommended in the annual report of the records officer for 1890. Metal adjustable shelving, while more costly than wooden shelving, is believed to be more economical in the end, on account of its lightness and durability and the ease with which changes in the filing capacity of any section can be made.

Immediate action on the records officer's letter of June 15, 1891, is urgently recommended in order that the records may be saved from destruction and room provided for those now in the War Department building.

A new system of lighting is also urgently needed, and must be supplied whenever interior shelves are constructed. The interior shelves should be first set up so that the records now on the wall shelves may be transferred thereto and thus save the labor of rearranging them.

ANNUAL REPORT TABLES.

The general meteorological tables for the United States, as printed in the annual report of the Chief Signal Officer for 1890, p. 273 to 649, were prepared in the division during the year. These tables are necessary adjuncts in the current work of the division, and enable the office to supply the public with much information which could not otherwise be furnished.

Through the valuable coöperation of the Public Printer the typographical appearance of these tables has been very much improved. The larger and more distinctive type has, moreover, added to the facility with which the data may be consulted.

CORRESPONDENCE.

The correspondence of the division embraces all matters pertaining to the preparation of the meteorological records of the Signal Service, the correction of monthly forms and reports, the elevation of instruments, the establishment and equipment of new voluntary stations, the acknowledgment of voluntary observers' reports, and the transmission of meteorological data to the public.

Letters were prepared in the division as follows:

For the autograph signature of the Chief Signal Officer, press-copied and mailed in the records division	714
For the signature of records officer, press-copied and mailed in the correspondence division	6,711
For the signature of the records officer, including circular letters, acknowledgments, etc	2,384
Acknowledgment cards, circular letters, etc., not copied	9,858

Two thousand eight hundred and forty-six letters have been received and recorded during the year.

COMPILATION OF STATION RECORDS.

Under instructions from the Chief Signal Officer, the hourly wind travel at the principal stations of the Signal Service for 1881 and 1882 was counted and tabulated during the year. There are now available for use ten years' record of these data, 1881-1890.

The record of excessive precipitation, rainfalls of 2.50 inches and over per day and 1 inch per hour, has been extended throughout the years 1888, 1889, and

1890, thus completing a continuous record of these important data from the establishment of the stations to December 31, 1890.

MEANS BOOK.

The unsatisfactory condition of the retained meteorological records pertaining to the Signal Service stations throughout the country led to the preparation during the year of a permanent book of record for the entry of the monthly and annual meteorological values from the establishment of the Signal Service to the present time.

The necessity for such a book of record must be apparent to any one conversant with the many changes in forms and methods of preparing annual and monthly reports. The book is so arranged that when completed it will contain a meteorological history of each station, embracing the different exposures of instruments, location of station, extremes, averages, and other valuable climatic data.

A very considerable amount of work has been imposed on the records division in supplying stations with records, copies of which had not been made for the station files.

VOLUNTARY OBSERVERS.

The voluntary observers of the Signal Service have accorded a full measure of generous coöperation during the year. The increase, while not numerically large, is believed to be more of a permanent character than heretofore, the loss by resignations, deaths, removals, etc., being but 12 per cent, as against 18 per cent for the preceding year. The division has been successful in interesting the officials of one or more of the great trunk lines of railway in the matter of taking meteorological observations in the sparsely settled portions of the country. It needs no elaborate argument to show the usefulness of the data thus obtained, nor the advantages of having some central authority to collect and disseminate it.

The generous policy pursued with reference to the loan of standard instruments to old voluntary observers, or new observers in localities not already occupied, has operated to increase interest in climatological work and furnish a better class of reports.

The loss of self-registering thermometers by breakage has been quite large, as noted in former years. One hundred and forty-six of such instruments were broken during the year, a large proportion of them before the Government had received any returns in the way of observations. The breakage in the case of ordinary thermometers was but twenty-two.

There were issued to voluntary observers during the year:

Exposed thermometers	103
Maximum thermometers	345
Minimum thermometers	310
Rain gauges	253
Total	1,011

The number of applications for expensive instruments, barometers especially, has been unusually large during the year. A lack of the necessary instruments and other causes has made it impossible to comply with these requests.

The table below shows the number of coöperating observers in each State for 1890 and 1891 ·

States and Territories.	Voluntary and State weather service.		Medical Department, U. S. Army.		Railroad.		Total.	
	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.
Alabama	24	22	1	1			25	23
Alaska	3	2					3	2
Arizona	33	40	10	6	9	11	52	57
Arkansas	25	29	2	1			27	30
California	45	44	8	8	154	153	207	205
Colorado	75	95	3	3			78	98
Connecticut	27	27	1	1			28	28
Delaware	1	2					1	2
Dist. of Columbia	1	1	1	1			2	2
Florida	16	18	2	2			18	20
Georgia	18	15	1	1			19	16
Idaho	10	10	2	2			12	12
Illinois	44	44	2	2			46	46
Indiana	32	29					32	29
Indian Territory	2	4	2	1			4	5
Iowa	44	76					44	76
Kansas	99	81	3	3			102	84
Kentucky	33	19	1	2			34	21
Louisiana	43	40	1	1			44	41
Maine	15	14	2	2			17	16
Maryland	13	12	1	1			14	13
Massachusetts	74	77	2	2			76	79
Michigan	103	96	3	3			106	99
Minnesota	26	20	1	1			27	21
Mississippi	44	26	1	1			45	27
Missouri	51	58		1			51	59
Montana	7	7	7	6			14	13
Nebraska	48	63	4	4			52	67
Nevada	36	24			18	17	54	41
New Hampshire	23	23					23	23
New Jersey	35	42					35	42
New Mexico	11	18	6	3	2	2	19	23
New York	67	107	12	13			79	120
North Carolina	22	27					22	27
North Dakota	9	17	5	5			14	22
Ohio	66	56	1	1			67	57
Oklahoma	1	2	2	2			3	4
Oregon	37	34			2	2	39	36
Pennsylvania	87	69	2	2			89	71
Rhode Island	10	10	1	1			11	11
South Carolina	27	23					27	23
South Dakota	20	28	4	4			24	32
Tennessee	38	37					38	37
Texas	65	73	12	11			77	84
Utah	16	16	2	2	6	6	24	24
Vermont	13	12					13	12
Virginia	18	19	2	2			20	21
Washington	5	13	5	5			10	18
West Virginia	9	7					9	7
Wisconsin	20	67					20	67
Wyoming	7	7	6	5			13	12
Miscellaneous	17	23					17	23
Total	1,615	1,727	121	112	191	191	1,927	2,028

Coöperating voluntary observers of all classes on July 1, 1890	1,927
New observers obtained during the year ending June 30, 1891	381
Resignations, deaths, removals, etc., during same period	280
Observers reporting on June 30, 1891	2,028
Net gain during the year	101

SPECIAL WORK OF THE YEAR.

The widening of popular interest in meteorology and official recognition of its applicability to many matters of legislation have been clearly apparent in this division, which has been called upon to do much work of a special character in addition to a sufficiently engrossing routine duty. The more important of these matters may properly be mentioned.

(1) *Climate of Texas.*—During the last session of Congress the Senate, by resolution, called for a complete report on the climate of Texas, with particular reference to its bearing upon economic agriculture. Upon receipt of instructions, this division compiled tables of all existing data of temperature and precipitation in the State under examination, computed and charted mean values, and in general prepared the material for the report, so far as concerned these two elements of climatic investigation, the mean temperature and mean rainfall.

(2) *Michigan temperature normals.*—The charts of normal temperature for the State of Michigan, half completed last year, were finished during the present. The charts from July to December were published in serial issues of reports of the weather service of that State.

The suggestion made in this connection last year is continued as an urgent recommendation in this. The entire mass of temperature data now filed in the records of this office should be charted, both for the purpose of placing it in convenient shape for further study, and also that erroneous values found therein may be corrected. It is scarcely necessary to remark that the charting of data for any given area will almost infallibly bring to light the greater part of the errors which inevitably occur in any extensive compilation.

(3) *Temperature normals by decades.*—During the year there have been prepared seventy-two charts showing the normal temperature conditions throughout the United States and Canada at 8 a. m. and 8 p. m., seventy-fifth meridian time, by decades, three decades to each month. These have been published in a limited edition for use in the daily routine of the forecast division, both as a matter of public economy and in the interests of improved service.

The term "decade" is used in reference to ten-day periods, counted from the first of each month, and the term is continued to the last decade of each month whether it contains eight, nine, ten, or eleven days. This division of monthly periods into decades is one which has not been attempted prior to the administration of the present Chief Signal Officer, yet it must commend itself to all who are familiar with the rapid change of mean temperature from day to in the day early spring and autumn months. At these seasons it is by no means uncommon to find a difference of 12° between the mean temperatures of the first and last days of the month, so that in using a normal for the month, which is approximately the normal of the fifteenth day, the values for the first and last days must necessarily be about 6° in error, and for the intervening days proportionately less.

To appreciate the amount of work done by this division in preparing these charts it is necessary to understand the methods by which these decades normals were computed, and the statement will illustrate the condition of the early records of the Signal Service.

Although the Signal Service has been in existence upward of twenty years it has not in that period accumulated sufficient actual observations at any one hour or set of hours from which normal values could be derived. Changes in the hours of observation have been so frequent that instead of one unbroken telegraphic series of twenty years' observations, there are six series, irregular in length, and made at different hours.

In addition to the telegraphic series, observations were made at 7 a. m., 2 and 9 p. m. local time, from the establishment of the Service to September, 1880; at mid-day, Washington mean time, from August 1, 1871, to December 31, 1879; at 11 a. m. from January 1, 1880, to December 31, 1884; at 7 p. m. from July 1, 1881, to December 31, 1884; from January 1, 1885, to April 1, 1887, at 11 a. m. and 7 p. m., seventy-fifth meridian time, and in addition special observations were made for short periods in 1879, 1880, 1885, 1886, 1887, and 1888.

From the observations above mentioned, the telegraphic series extending from November, 1879, to June 30, 1888, was selected as being the least objectionable, the only departures from the hours of 7 a. m., 3 and 11 p. m., Washington mean time, being on January 1, 1885, when seventy-fifth meridian time, eight minutes faster than Washington time, was adopted, and on January 1, 1887, when the time of taking the night observation was changed from 11 to 10 p. m. Starting with this series, which affords nine years' observations at 7 a. m. and 3 p. m., and eight years at 11 p. m., as a basis of comparison, the mean values of observations at all other hours during the same period were computed and tabulated for examination. These values were further supplemented by computing the averages of the local and other special observations for the several hours at which they were taken during the period between January, 1877, and October, 1879. There were thus obtained observations of greater or less length, covering fairly well the hours of the day between 7 a. m. and 11 p. m., seventy-fifth meridian time, when the changes of temperature are most rapid. It was then possible, by employing the ratios found to exist between the temperatures values of the several hours of the day, to so coördinate the averages found in the shorter series with those of the longer as to give an approximate equivalent of about twelve years' observations at each of the critical hours of temperature changes.

The observations from about sixty stations, selected so as to represent the entire area of the country, were thus reduced, and by charting the averages for the several hours of the day, a curve representing the normal daily variation was obtained.

A comparison was then instituted between the curve so obtained and the values given by about three years' records of standard thermographs, with a view of verifying the previous work of reduction. No material error was discovered, however, nor is it believed that any of the normals will be found sensibly in error when checked with the results of many years' actual observations. With reference to the accuracy of the thermographs in use it seems proper to say that it had been ascertained before putting them into operation that with careful manipulation, and frequent checks by comparison with standard mercurial thermometers, the possible error in the results obtained therefrom would seldom amount to more than a fraction of a degree in mean values. Single readings would of course differ from readings of standard instruments by a degree and sometimes more, but a comparison of the hourly averages obtained from both sources seldom showed differences greater than a tenth of a degree.

Having, as before stated, the curves of average diurnal variation of temperature for sixty representative stations it became an easy matter to draw normals for 8 a. m. and 8 p. m. therefrom, and, by interpolation, to reduce the averages obtained at intervening stations for the hours of 7 a. m. and 11 p. m. respectively, to corresponding values at 8 a. m. and 8 p. m.

The value of the results presented will be appreciated best by those who have attempted similar lines of research in the past and by the constantly increasing number of persons who find themselves in need of reliable climatic data assembled in working periods. More especially will the data be valuable when an attempt is made, and the time is not far distant when such an attempt must be made, to reduce the great mass of temperature observations in the files of the Signal Office to comparable results. The table of temperature corrections, published within the year, used in connection with these charts, will enable anyone to construct, as regards mean hourly temperatures, a climatic map of the United States in which no serious error can obtain.

As these charts have become a necessary aid in the work of the forecast division, so, it is confidently expected, they will also become valuable adjuncts in the duties of local observers, with reference to forecasting the weather and furnishing information to the press and general public. It is also anticipated that observers charged with the preparation of weekly or monthly crop bulletins for the benefit of those interested in agricultural pursuits will be able to widen the scope of their labors by having at command reliable normal data for their own as well as contiguous States.

(3) *Extremes of temperature by decades.*—In addition to the charts of decade normal temperatures, thirty-six additional charts were prepared to show by decades the extremes of temperature which have been recorded in the United States from 1872 to June 30, 1891, with the year and day of occurrence. These charts show for each locality the limits within which the temperature may be expected to range, and also, by comparison, the relation which any unusually high or low temperature may bear to the extremes previously experienced.

The extremes of temperature are of far greater interest from a climatic than from a meteorological standpoint. The frequency of very high temperatures in summer or of exceedingly low temperature in winter is that climatic feature which forcibly impresses itself on the ordinary man, and which goes farther to convey a definite idea of local climate than any other element. While, therefore, the charts of maxima and minima of temperature do not possess the same scientific value as many other publications of the Signal Service, yet in interest they will probably surpass them.

The data embraced in these charts are valuable for reference for many purposes. The physician can easily deduce therefrom an opinion as to whether the contingency of dangerous temperatures has passed or is approaching; the farmer can note whether high temperature may yet come, or whether there soon will come a decade in which the possibility will exist of early damaging frosts which may entirely destroy some delicate and valuable crop, such as tobacco, and the shipper to remote points may know how and when to insure the satisfactory transmission of costly and delicate consignments which are susceptible to serious injury by either great heat or extreme cold.

There were also prepared charts showing the chief maxima and minima temperature, respectively, in the United States and the Dominion of Canada from the beginning of the use of self-registering thermometers (generally in 1872 in the United States) to the present time. The data for Canadian stations for very recent periods were not available, but it is believed that the values given will not be altered by additions of later data.

The information contained on these charts has also an important bearing on many of the varied interests of commerce and agriculture, and will be found useful in the current work of the central office as well as of branch stations.

(4) *Average cloudiness.*—For the aid of those who investigate climatology in its bearing upon crop production, a series of twelve charts has been prepared, showing by months the average percentage of cloudiness at Signal Service stations.

The data on which these charts are based has been derived from eighteen years of tridaily visual observations between the years 1871 and 1888, except at stations established subsequent to the first-named year; generally not less than four years' record has been used at any station. Total cloudiness is represented by 100 per cent, and an absence of clouds by 0.

While the cloud area on synoptic charts is a valuable factor in indicating coming changes in the weather, it can not be said that the mean values of cloud distribution are equally applicable in modern weather forecasting. Their efficiency is to be found rather in their application to questions of climatology, wherein it is apparent that sunlight and cloudiness have important influences on health and many agricultural and commercial interests.

The average quantity of cloud, mist, and rain to be found in any locality determines to a great extent the suitableness of that locality as a habitation for persons requiring a maximum amount of sunlight and opportunity for exercise in the open air. The medical profession, notwithstanding the importance of the question, is yet without standard cloud maps for the United States.

Due proportion of sunlight, warmth, and moisture is necessary to produce healthy vegetation and insure the ripening of growing crops in certain months of the year. Cloudiness is also an important element, since the presence of clouds naturally results in screening the earth from excessive insolation, or in other words, diminishing the heat received by vegetation from direct rays of the sun. So, also, acting as a screen, it prevents, in a measure, the radiation of heat from the earth into space, and thus materially tends to modify and reduce the diurnal range of temperature, so that growing vegetation is not subject to as great cold as would otherwise obtain during the night, nor, on the other hand, does it receive the full amount of solar heat by day.

(5) *Probability of rainy days.*—To present a factor which legitimately enters into successful prediction of the weather, twelve charts, graphically presenting the probability of rainy days, have been prepared. The data on which these charts rest have been derived from eighteen years' Signal Service observations between 1871 and 1888. Records from stations established subsequent to 1871 have also been used, especially in regions where older stations afforded imperfect or incomplete data; but no record of less duration than five years has been used without indicating its character.

For the purposes of this study a day is classed as rainy on which occurred precipitation of at least 0.01 inch. The average number of such days for all months at each station has been calculated and referred to the whole number of days in the month, resulting in a percentage which shows the probability of rain at the various stations for each day of the month.

The data above referred to have been expressed in percentages rather than in absolute numbers, for the reason that the former method eliminates the inequalities due to the unequal length of the different months, and enables the student to apprehend at once the true significance of the records so expressed.

At a few stations on the Pacific coast, where the calculated percentages of rainy days are less than five-tenths of 1 per cent for certain summer months, zero has been entered instead of the fractional value. It is not to be understood, however, that the probability of rain is absolutely zero. Rain may and does fall in that region in all months of the year, but the fall of the summer months is so infrequent that the probability of rain occurring at certain stations during the summer months is reduced to a quantity which for all practical purposes may be neglected.

The probability of rain for all months and all sections of the country, as shown on these charts, is a legitimate factor in tho successful prediction of the weather, and one which should not be neglected.

(6) *Investigation of the winds.*—Thirty-six charts have been prepared, embodying the results of recorded wind observations under the four following topics:

(*a*) Average velocity at 65 representative stations at the hours ending 8 a. m. and 8 p. m., seventy-fifth meridian time; (*b*) prevalent direction at a number of stations east of the Rocky Mountains; (*c*) highest and lowest average hourly velocity, with the hour of occurence; and (*d*) the average number of times a velocity of 25 miles or more has been observed at the principal lake stations.

The vast amount of wind data available for this study will be appreciated when it is said that there are on file at this office continuous records of wind velocity from self-registering instruments, beginning in 1872 and continuing to date or to the time of closing tho station. This matter accumulated, but no effort was made to arrange it for reference or study until, in 1884, the hourly wind travel was tabulated on a series of special forms; monthly averages were not computed, and it does not appear that any attempt was made to connect these results with the current work of the office.

The next effort was on a considerably larger scale, and so disproportionate to the clerical force of the division as to necessitate different treatment. The March records for the years 1884 to 1887, inclusive, were computed, and the work was sufficient to show the physical impossibility of handling the computation in this office. As a result, the forms for the remaining months of this period were returned to the observers, by whom the sums and averages were computed. From these results were deduced the average velocity for each hour of the day for all months of the year.

But these values proved unsatisfactory by reason of the shortness of the record and other causes. This led to a verification of the work in the office, and at the same time the records for 1883 were returned to the observers for completion. The years 1881 and 1882 were likewise reduced, and since 1888 the original forms have been computed by observers before transmission to this office, so that there are now available ten years' records of hourly wind movement at the principal stations in the United States.

It has not been possible, however, on account of the very great labor involved and the delay incident to the completion of the records for 1881–'82, to calculate the average hourly velocity for all stations on a ten-year basis. The best that could be done with the clerical force available was to compute a seven-year average for about 60 representative stations, a comparison of the seven-year averages with the ten-year normals computed for a few stations having first shown that the differences between the seven and ten year averages were, as a rule, less than half a mile of wind.

No attempt has been made to apply a correction for the differences in velocity due to changes in the elevation of the anemometers. In general the changes of elevation have not been of sufficient importance to warrant a correction being applied except for purposes of great refinement. It should also be added that the Robinson factor 3 has been used in computing the original velocities, and that to reduce to true velocities the corrections published in General Orders, No. 36, 1890 (see also Appendix No. 25, Annual Report of the Chief Signal Officer for 1890), should be applied.

The foregoing remarks apply also to the data entered on the 12 charts of maxima and minima velocities, with the exception that at the stations indicated by an asterisk (*) the data have been drawn from records less than seven years in length.

The charts of maxima and minima velocities show also the hour at which these velocities occur, and by taking the difference between the extremes the amplitude of the mean daily variation is obtained.

The average number of winds of 25 miles or more per hour has been computed for ten years (1876 to 1885), except for Marquotte, Mich., where the record is for nine years; Rochester, N. Y., and Sandusky, Ohio, seven years, and Mackinaw City, Mich., three years. The velocities given in the table have been determined from the rate for fifteen consecutive minutes.

The prevailing direction for the wind, and also the direction next in order of frequency as determined from eye observations for a period of seventeen years, has also been charted, as being of value in the work of local forecast officials.

A lack of observations at 8 a. m., the present morning observation hour, has necessitated the use of observations taken at the following times, viz: Nine years' observations at 7:35 a. m.; five years' observations at 7 a. m., Washington mean time, and three years' observations made at 7 a. m., seventy-fifth meridian time (eight minutes faster than Washington time); but as the hours above mentioned do not differ on the average more than thirty-five minutes from the present hour, it is believed the values given will represent with a fair degree of accuracy the average actual conditions at 8 a. m. The difference in time between the present evening hour of observation and the hours from which the data entered on the charts were obtained is, however, much greater, averaging nearly three hours. The latter were deduced from two years' observations at 11:35 p. m.; twelve years' observations at 11 p. m., Washington mean time; two years at 11 p. m., and one year at 10 p. m., seventy-fifth meridian time.

The values for these hours may not hold good in all cases for 8 p.m., but it is believed that with careful observation of the shift of the wind at or near the latter hour, especially during settled weather, the charted data may be used with safety.

The diurnal variation of wind direction in the United States has not been investigated to any considerable extent, so that but little is known of its tendency except in a general way. It may be said, however, that in the northern hemisphere there is a well-defined tendency to veer a little in the morning, and to back through the same arc in the afternoon. This inclination, however, is clearly subordinated to the influence of pressure changes and distribution, and can not be detected except in settled weather.

ISOBARS, ISOTHERMS AND WINDS, 1871-'73.

(7) Thirty-six charts showing the isobars, isotherms, and winds in the United States for each month from January, 1871, to December, 1873, were completed during the year.

The publication of charts showing monthly isobars, isotherms, and prevailing wind directions for the United States has been regularly made by the Signal Service from the latter part of the year 1873 until the present time. Many demands have been made upon this office for information concerning the temperature, precipitation, and wind directions for the different months during the years 1871, 1872, and 1873, prior to the regular publication of monthly charts. In view of the fact, however, that this office did not receive reports from voluntary observers until 1874, it was impossible to furnish the data required, or to publish charts requested. Some time since Prof. S. P. Langley, of the Smithsonian Institution, kindly placed at the disposal of the Chief Signal Officer of the Army all the original and complete meteorological data within the control of the Institution of which Prof. Langley is secretary. The meteorological information thus furnished supplemented very largely the data already accumulated from other sources, and enabled the Chief Signal Officer some time since to publish a series of monthly rain charts of the United States for the years 1871, 1872, and 1873. It has only lately been possible to arrange the data bearing on the atmospheric pressure, the mean temperatures, and prevailing wind directions for the months in question.

All available sources, whether pertaining to the observations made by the officers of the Medical Department, under the direction of the Surgeon-General of the Army, to reports by voluntary observers of the Smithsonian Institution, by officers of State and other institutions, or those made by regular observers of the Signal Service at stations occupied at different times during the period under consideration, have been exhausted in the preparation of the charts above mentioned.

DIURNAL VARIATIONS OF PRESSURE AND TEMPERATURE.

(8) The investigations under this head, described at some length in the records officer's report for 1890, were brought to a close during the year. The results have been published, and will soon be ready for distribution. The value and scope of these publications will be apprehended best by an examination of their contents. Suffice it to say, that the state of our knowledge respecting the phenomena above referred to has heretofore depended mainly upon the results of hourly observations at Toronto, Canada, and Mohawk, N. Y., supplemented with

observations covering short intervals of time at about eighteen places. (Smithsonian Contributions to Knowledge No. 227.) The values obtained from these observations were, unfortunately, not applicable to the greater portion of the country, and especially to that portion in which the greater number of observations at irregular hours have been and are maintained.

APPLICATION OF CHARTED DATA TO FORECASTING.

The main purpose to be subserved by the preparation and publication of these several charts and reports is to assist in securing the precision which is now demanded and required by the Chief Signal Officer of forecast officials. It is considered that the possession of a series of standards for every element of the meteorological predictions will further enable those officials to make use of definite terms in fore-announcing weather changes. In this regard a noteworthy development has been made in the customs of this department of the Service which may be briefly summarized.

The first official weather predictions of the Signal Service were made on February 19, 1871. At this time three daily predictions were made for eight hours in advance, the districts covered by each set of predictions were not precisely defined, and the elements predicted were equally indefinite. The form of language adopted for these first forecasts was loose and general; it provided so broadly for contingencies that it could seldom be proved absolutely in error, yet it could never be proved absolutely correct. In October, 1872, the predictions were made for twenty-four hours in advance, in nine districts, the elements or topics of the prediction still remaining indefinite. In 1874 the number of districts was increased to eleven, and for the first time the elements of prediction were defined as wind, weather, pressure, and temperature. The districts were reduced in 1875 to ten, and in 1877 the element of pressure was abandoned as a part of the prediction. No further change was made until July, 1885, when predictions were authorized for thirty-two hours in advance, and May, 1886, when the system of predicting districts was replaced by States and parts of States.

But in September, 1887, a newly-inaugurated system made itself felt by the change in verifications from fourths to tenths, showing the intention to hold the predicting officer to a stricter account of his success or failure. In July, 1888, predictions were ordered for thirty-six hours in advance, and after that time for twenty-four hours, and for the two elements of weather and temperature.

The new methods introduced since 1887 have been remarkable for the greater precision impressed by the strong personality of the Chief Signal Officer upon the forecaster, as absolutely essential to the proper performance of his work. He is now required to predict for any individual State the approaching changes of weather and temperature, and is held to strict accountability for the forecast he has made. The loose probability of the earlier system which might mean anything, and frequently meant nothing, has been supplanted by a system of definite and precise statements, giving positive prediction. It is to be noted that under the present Chief Signal Officer the Signal Service is the first, and as yet the only predicting Bureau which has ventured to put to practical test the belief that meteorology is an exact science, to such an extent that daily deductions therefrom may be presented in positive statements. European meteorological bureaus are still in the era of guarded and timid suggestions as to what weather may possibly come, from which this service has been emerging more and more confidently during the past four years.

CLIMATIC MONOGRAPHS.

(9) In addition to the continuous routine of record and comparison of results which is entailed upon this division by its receipt of all data of systematic meteorological observations throughout the country, the preparation of the report on the climate of the arid region (H. Ex. No. 287) made necessary the compilation of all climatic records on file in this office from the States of California, Nevada, and Colorado, and the Territories of New Mexico, Arizona, and Utah. For each political division above noted were compiled and reduced exhaustive tables of temperature and precipitation, and the means of the longer or shorter series of observations were entered upon twenty-four maps of the single States or Territories. Other data in connection with the investigation was supplied as called for by the Chief Signal Officer, who discussed all the results in the preparation of his report.

To Lieut. W. A. Glassford, Signal Corps, was intrusted the writing of monographs upon the climate of New Mexico, Arizona, California, and Nevada, three in number, which were submitted to Congress, and have been published in the document referred to. Beside the discussion of the question of irrigation in the divisions under consideration as dependent on rainfall, a presentation was made of certain climatic phenomena peculiar to the region, and suggestions were offered looking to a solution of these interesting meteorological problems. Thus in the monograph of Arizona, the question of precipitation as influenced by elevation was presented. In the monograph of New Mexico further consideration was given to this topic, and from the discussion arose an exposition of the theory of the duality of the rainy season in those two Territories with particular reference to the *temporales* or "shepherd's rains."

Similarly, in the monograph of California and Nevada, the opportunity was improved to examine the phenomena of the wet and dry seasons of the Pacific coast, and to present an explanation thereof, which seems to harmonize all observations.

It is not claimed that new methods have been advanced, but well-determined principles have been carefully applied to the elements of the problem, deducing therefrom a series of conclusions, which are found applicable, not only to all the recurring types of the climate of that State, but with equal validity to interruptions of those types which have hitherto been held anomalous.

From the local observations was deduced an orderly arrangement of typical weather forms, these were closely brought into correlation with the continental types, and from this particular and general study a theory has been drawn, which, it is considered, will be found in great part, if not entirely, the basis for future climatic study of that interesting region.

With the completion of the report on "irrigation and water storage in the arid regions," the Signal Service has put forth through the medium of special reports to either branch of Congress rainfall statistics for the entire country west of the Mississippi River except Louisiana, Arkansas, Missouri, Iowa, and Minnesota, and temperature data for the same region, with the exception of the States and Territories of Louisiana, Arkansas, Missouri, Iowa, Minnesota, North and South Dakota, Montana, Idaho, Wyoming, Kansas, Indian Territory, and Texas.

SENSIBLE TEMPERATURE.

(10) With intent to secure materials for the discussion of sensible temperature, records division circular letter No. 11 was issued August 27, 1890, calling for report on the monthly average reading of the wet and dry bulb thermometers at 3 p. m. and the monthly average reading of the wet and dry bulb thermometers deduced from the 7 a. m., 3 and 11 p. m. readings. This circular met with satisfactory response, and a considerable volume of data has been accumulated. Under personal direction of the records officer these data have been thoroughly collated by months and in great part reduced for comparison. As each month's records have been reduced the results have been entered upon charts, of which six out of the necessary thirteen have been prepared. The discussion of the interesting problem thus presented has been unavoidably postponed by the press of other business of this division.

INDEX OF METEOROLOGICAL OBSERVATIONS.

(11) In the last annual report of this division report was made of the progress in the preparation of an index of meteorological observations in this country. This work has been completed during the year, and its results have been made manifest in the publication of a strictly limited edition, sent to the more prominent stations for the consultation of those whom it may concern. The volume of more than 300 pages forms a check list of all observations of meteorological phenomena made in each of the United States from the earliest times of which record has been preserved in the office of the Chief Signal Officer. It is believed that no series of observations has escaped scrutiny, with the notable exception of the system, the pioneer of all government work in this science, inaugurated by the Commissioner of the General Land Office, of which the records have never received scientific examination, and if they still exist, do so only in manuscript.

The sources upon which this index rests are several. For the period ending with 1873 reliance has been placed upon the printed and manuscript records of the Smithsonian Institution. The accuracy of these records it is now possible to check by reference to the original reports filed in this office on special deposit, as elsewhere noted. From 1874 to the present, the chief source of information has been the records of voluntary observers of the Signal Service. The records of several orders of signal stations in operation since 1870 have been included. The coöperation of the Surgeon-General of the Army has placed in the custody of this office the long and valuable series of observations conducted at the several military posts for nearly three-quarters of a century. The records of the various State weather services have been thoroughly canvassed and incorporated in this list, as have been the reports preserved by the Light-House Board, by the official survey bureaus, by the Patent Office, and by several railway systems. In fine, it may be said that all authorities have been searched for contributions of data for American meteorology, and in general, as the search has been thorough, it may be said that few, if any, observations have escaped notice.

The index presents the geographical constants of each place at which observations have been taken, the class to which the station belongs, whether voluntary or systematic, the length of record with including dates, and the character of the reports. This information has been collected under States and Territories, which have been alphabetically arranged. Within the States the stations are grouped geographically under their respective counties, which are arranged for convenience of reference in tiers across the State from west to east, beginning at the northwest corner. While not facilitating reference to any particular entry by name, it is believed that this arrangement will be found efficient in making ready reference to all stations in any given neighborhood.

The purpose of this index will be subserved if it affords students of climate reliable knowledge of the material available for their examination. The value of the index will by no means be confined to the central office; it will also greatly aid observers in charge of the more important Signal Service stations in their current work, enabling them readily to supply applicants for climatological data with information as to kind and extent of observations of record for all sections of the country, period covered, etc.; but at best it is somewhat preliminary and tentative in nature. To obtain the best results from the constantly growing mass of records it will be necessary to compile topical indexes for each of the elements recorded on the usual form of report. When this has been done the respective values of the several subjects of report may be examined and discussed, and the importance will appear of preparing data books for other elements similar to those of mean monthly temperature and precipitation now in daily use in the office. While it is yet too early to advocate the preparation of such a series for every element of the reports, it is safe to say that a great advantage would be afforded by compiling the recorded maxima and minima of temperature. The office has abundant material on this subject, but it is practically inaccessible in the cumbrous volumes of original records.

TAR, PITCH AND TURPENTINE.

(12) Efforts have been continued to secure the necessary data for the proper study of the best climatic conditions for the production of naval stores. Attention has been particularly directed upon the tar, pitch, and turpentine industries of North Carolina, and while the immediate results are small, it is confidently expected that the interest aroused will lead to definite and practical results.

In the prosecution of other duties, the records officer has improved the opportunity to make some personal inspection of the region under examination and learn the peculiar factors which correlate this industry to climate.

RAIN-GAUGE STAND.

(13) During the year the records officer has recognized the necessity of making provision for the uniform mounting of the service rain-gauge, as supplied to voluntary observers. The need most definitely arose in connection with the extension of the voluntary system on the treeless plains of the West, but the utility of the device became so promptly manifest as to warrant its extension to all gauges to be sent out in future.

Reference to the accompanying plate will show the details of the stand. It is designed, in the first place, to serve as a packing box, in which the gauge may be safely transported to its destination. When the gauge has been removed from the box, the lower portion of the box is ballasted with stone or earth as high up as the extent of the open corners, and the end piece, which served to close the box in transit, is slipped just down to the top of the ballast and there screwed in place, as indicated by the holes already bored. The box thus altered is partially sunk in the ground to such an extent that when the gauge is put in place its bottom shall be as nearly as possible at the level of the soil.

This simple device, which costs little more than any box in which to pack the gauge for transportation, is efficient in securing uniformity in elevation, and, to a large extent, exposure of these instruments. Together with the thermometer-shelter described in the last annual report—plate of which is inserted in this—it provides an inexpensive support for the voluntary observers.

GENERAL SYNOPSIS ON MAPS.

(14) In October and February, notably the latter, the records officer, then taking his tour of duty as forecast official, instituted the system of preparing a general synopsis for each map in popular terms, a system which met the favor of the Chief Signal Officer. This step was taken in the direction of bringing the forecasts of the Service more directly to the people who have never received the training sufficient to enable them to comprehend the climatic meaning of the isobars and isotherms upon the daily map. The fundamental proposition of this system of general synopsis was to trace, in popular language, the movement of each storm center during the preceding twenty-four hours, and to draw attention to the extent of the verification of the last predictions by such movement, and in case the storm failed to travel over the track pre-announced, to indicate the physical causes which produced the divergence. Having thus discussed the last day's movement of the storm, the popular synopsis indicated its probable movement for the day coming.

It was felt in developing this system that the number of people who could appreciate the curves upon the weather map was few comparatively, but that all who would be likely to look at the daily maps, with even a casual glance, would look upon such a storm as a concrete entity, and would find interest in tracing its course and justifying by their own sight the forecast which announced that the storm would reach them or pass by them.

It was during the last-named month that the shading in the daily weather maps, showing rain and temperature changes, was introduced.

HISTORY OF THE SIGNAL CORPS.

(15) The records officer was designated by the Chief Signal Officer to prepare the historical sketch of the Signal Corps requested by the Military Service Institution. This work has been completed during the year and is now in the printer's hands, and will shortly appear in the Journal of that institution. In view of the fact that the Journal, being a private publication, may not reach many of those at home and abroad who are interested in the history of military signaling and telegraphy, it is herewith submitted for publication in your report. Permission to do so is given by the Military Service Institution.

In the preparation of this history it has been necessary to enter upon a careful examination of the records of the office from the earliest period of the war. This examination has led to a recognition of the fact that many of the original documents have been lost. Great assistance was derived from the volumes issued by the War Records' Office, which were available to and including volume 60 of the serial numbering. These volumes, containing more than 50,000 pages, were examined page by page by two persons, and a card index was prepared of such of their contents as relates to signaling and the Signal Corps.

The third source of material was found in the published reports of the office.

The index to the portion of the war period of the corps above noted was intended to be submitted for publication with this report.

SYNOPTICAL SKETCH OF THE PROGRESS OF METEOROLOGY IN THE UNITED STATES.

(16) This report marking the close of the performance of meteorological duties by the Signal Corps of the Army, it has seemed a proper occasion for the presentation of a brief synopsis of the progress of meteorology in the United States. The following paper has been prepared, not as an exhaustive history, but to present in a summary way the several periods of the study of this science in this country, which now is foremost in the practical application of meteorology, and to show the development of the system from obscure beginnings to its present position as a highly organized department of the Government.

The initial point of meteorology as a physical science is determined by the invention of its essential instruments, the barometer and the comparable thermometer. Before these discoveries there existed only desultory observation of the weather, unrecorded save in the folklore of unskilled people, available for future guidance only as weather proverbs, shepherds' calendars, and the like;

yet this loose and fallacious meteorology took such a strong hold upon the popular mind that its proverbs still remain in common use, and its irrational predictions have not entirely vanished from popular almanacs. The study of the weather was not only popular in the sense that it was a favorite pursuit of the people, but it possessed sufficient inherent interest to claim the attention of men of science as soon as they found themselves in possession of an instrument of precision with which to prosecute their researches.

The first datum point was Torricelli's discovery of the mercurial barometer in 1645, which was more prominently brought to notice as the instrument of atmospheric measurement by the experiments of Pascal in 1648. The suggestions made by Pascal were first exhaustively put into practice by Boyle in 1659-'60, who is therefore entitled to rank as the first student of scientific meteorology. The institution of the Royal Society of England provided a permanent record of scientific labor, and its philosophical transactions from the beginning contain many notices of weather study by the aid of the barometer. As early as 1684 Plot and Lister, in the Philosophical Transactions, expressed their hope of utilizing the new instrument for the purpose of predicting the weather, an object which dropped from sight during a long succession of years.

The second datum point, and the one which marked the full establishment of the science, was the general distribution in 1720 of the first comparable thermometer with Roemer's scale which bears the name of its manufacturer, Fahrenheit. Within three years the Royal Society, still maintaining its activity in the prosecution of meteorological research, issued to the world Dr. James Jurin's scheme of an association for forming meteorological diaries. This step established meteorology of record, and Jurin has claim to be regarded as the father of modern statistical meteorology. Even earlier than this is found the first attempt at meteorological record in the pre-instrumental period. Walter Merle, fellow of Merton College Oxon., England, maintained a daily record of the weather for the seven years 1337-'44. Quite recently this record has been brought to light in the Bodleian library—ten skins of vellum written upon in contracted Latin. It is now in process of fac-simile reproduction and translation, interesting to the curious as the earliest muniment of the science.

These labors of the physicists of the Royal Society possess a direct and intimate relation to the meteorological study of the United States. One of Dr. Jurin's circulars found its way to Charleston, S. C., where Dr. Lining in 1738 began to maintain a record of temperature and precipitation, which he reported to the Royal Society. American interest in the science was not confined to mere following out the plans of the English investigators, for in 1728 Isaac Greenwood, professor of mathematics in Harvard College, presented a form for meteorological observations at sea, thus by more than a century anticipating in a way the efforts of Lieut. Maury, assigning as a reason for his suggested plan that marine observations "already are by far more numerous than what were ever made ashore, or, indeed, what can be expected thence for some ages to come."

The Charleston observations were followed by several other series of greater or less extent and completeness in different parts of the country, which, slowly increasing in number, prepared the way for the systematic collection of climatic data. It may be not without interest to present a list of these precursors of the modern system, with the date at which observations began:

For temperature:		For temperature—Continued.	
Charleston, S. C	1738	Deerfield, Mass	1806
Cambridge, Mass	1742	Newburyport, Mass	1806
Philadelphia, Pa	1748	New Orleans, La	1807
Williamsburg, Va	1760	Brunswick, Me	1807
Bradford, Mass	1772	Castine, Me	1811
New Haven, Conn	1778	New Bedford, Mass	1812
New York	1782	For precipitation:	
Salem, Mass	1786	Charleston, S. C	1738
Fort Washington, Ohio	1790	Bradford, Mass	1772
Albany, N. Y	1795	Williamsburg, Va	1772
Andover, Mass	1798	Cambridge, Mass	1784
Natchez, Miss	1799	Morrisville, Pa	1790
Burlington, Vt	1803	Charleston, Mass	1792
Smithfield, R. I	1806	Stow, Mass	1795
Cincinnati, Ohio	1806	Natchez, Miss	1799
Mason, N. H	1806	New Haven, Conn	1804
Boston, Mass	1806	Monroe, La	1808
Concord, Mass	1806	New Bedford, Mass	1814

These several series of observations were the outgrowth of private interest, which often flagged in the absence of any directing influence; they were irregular in most cases; they were printed in publications not generally accessible, or remaining in manuscript, were exposed to the catastrophes which await written papers not preserved as public records. The time was ripe for some enthusiast who, by representing a central and directing agency, should keep alive the interest in meteorological record and secure the preservation of the results.

This enthusiast came forward in the person of Josiah Meigs, Commissioner of the General Land Office. He marks the dividing line between the vague efforts of the observers of the eighteenth century and that long period of observation and record which must be regarded as the first era of systematic meteorology in the United States.

Meigs was a man well equipped for the purpose which he set before himself in the administration of his office. Trained in the rigid discipline of the Yale College of the period, he served that institution as a tutor in natural philosophy and later was called to the chair of the same department. His interest in meteorology was displayed during his residence in Bermuda from 1789 to 1794, during which period he made observations on the meteorology of the islands, which he communicated to the Royal Society. His life was one of great hardship and poverty, which he suffered for the possession of political convictions unpopular in the surroundings where his lot was cast. It resulted that he was unable to give to meteorology that administrative attention which was his purpose until his appointment to the Commissionership of the General Land Office placed him in easy circumstances for the first time in his life.

On the last day of January, 1817, he wrote an influential member of Congress suggesting the passage of a resolution to provide for the keeping of meteorological registers at each of the land offices, and that the observations should be returned each month to the General Land Office. His plan contemplated the issue to each land office of the requisite instruments for observations of temperature, pressure, rain, and wind. He failed to secure the sanction of Congress, but issued a circular, April 29, 1817, in which he asked the several registers, his subordinates, to take regularly certain meteorological observations, for which he supplied blank forms. Purely voluntary as the service was, and without any financial support, it fell somewhat short of the plan suggested to Congress, for barometers were both rare and expensive. The blanks were ruled for a tridaily observation of temperature, wind, and weather, together with a column of remarks of a general and phenological character. The system attained considerable proportions from the beginning, but it seems to have lapsed on the death of the founder, in 1822. The records have never been collated and are believed to be preserved in bulk in the possession of the American Institute of New York. It is of interest to note that Meigs, from comparison of the voluntary reports sent him, was able to recognize the area of several cold waves, even though the insufficiency of his information precluded the discovery of their motion in progression.

The next system of observations was established by the Surgeon-General of the Army, and has been maintained as a system to the present day, although subject to various modifications as the conditions of meteorological study were altered. The office of the Surgeon-General was created in 1818, and Dr. Lovell was at once appointed. His first instructions to hospital and post surgeons directed them to keep a diary of the weather. The earliest registers filed under this system begin with January, 1819. For the first few years the only instruments furnished were the thermometer and the wind vane. In 1836 the rain gauge was added to the equipment, and in 1841 barometers and hygrometers were supplied to a few stations by way of experiment. In 1843 a new and more complete system was put in operation, and the military posts and hospitals were called upon to maintain a record of observations of the barometer, attached thermometer, detached thermometer, rain gauge, wet-bulb thermometer, and to note the clearness of the sky, the direction and force of the wind, and the direction and velocity of cloud movements. The observations of the wet-bulb thermometer were discontinued in 1849 and renewed in 1855 with a better instrument. The office transcripts of the original returns of the observing surgeons have been transferred to the Signal Service, where they are now preserved. The larger portion of these reports also exists in printed form. The results of the observations during 1820 and 1821 were published at the end of each year. Thereafter the results were grouped by convenient periods in the Army Meteorological Register, of which the first volume, published in 1826, contained the observations for the years 1822 to 1825, inclusive; the second volume, issued in 1840, contained the results for the years 1826 to 1830, and in an appendix reprinted the first volume; in 1851 the third volume was issued, with the tabulated observations from 1830 to 1842, and in 1855 the fourth volume carried the tables from 1843 to the end of 1854. This was the final meteorological publication of the Surgeon-General's Office. The records after 1854 were handed over to the Smithsonian Institution, and in due time were transferred to the Signal Service.

Within a few years the subject, which was too unimportant for Congress to consider in 1817, had attained a recognized position as entitled to public support. In 1825, but eight years after Meigs's ineffectual plea, the University regents of New York directed that each of the academies under their jurisdiction should be furnished with a thermometer and a rain gauge, and that the diligent report of observations should be an essential condition of their receipt of State funds. Further instructions from time to time directed observations of the wind and a variety of miscellaneous occurrences, considerable attention being directed upon phenological phenomena. The observations began in 1826 and were continued more or less completely to 1850. During this period sixty-two academies reported observations, of which three were complete for the whole term, and only three failed to record the precipitation. In 1849 the legislature made an appropriation for the purchase of improved instruments in order to conform the State system of observations with the more comprehensive system recently instituted by the Smithsonian Institution; a small sum was appropriated for salary of observers. The instruments provided by this appropriation were a mountain barometer, thermometer, rain and snow gauge, wind vane, and to a few stations wet and dry bulb thermometers. The system came into operation at the end of 1850, and thirty-five academies began the observations. From the first the humidity observations were a failure, owing to confusion of reduction tables and thermometric scales. In 1863 the legislature failed to make the small salary appropriation, and from that time the system rapidly declined, both from that cause and from the greater weight of the Smithsonian observations covering the same ground. The reports of these observations were published in the annual reports of the regents from 1826 onward. In 1855 the observations from 1826 to 1850 were collated and published, and in 1872 appeared a similar collation of the second system of observations, from 1850 to 1863.

Pennsylvania was the next to feel the influence of the new study. In 1834 was formed a joint meteorological committee of the American Philosophical Society and the Franklin Institute, of which James P. Espy was chairman and A. D. Bache a leading member. A circular was issued by the joint committee in the same year giving directions to observers. At this period less attention was paid to securing continuous record than to gathering information concerning individual storms which had attracted the attention of the committee. Something was accomplished by this method, but it was evidently not the method for systematic research. In 1837, however, the legislature appropriated $4,000 for the advancement of meteorology and intrusted its expenditure to the joint committee. Out of these funds there were authorized to be purchased for each county in the State a barometer, two common thermometers, a self-registering thermometer, and a rain gauge. This State grant in aid established in the year 1839, when it became available, 22 stations maintaining a record of temperature, to which 6 were added in the years next following; the stations recording precipitation under this system were but 7. Most of the records were brief and many were irregularly interrupted; the system died out in less than ten years, and its records found a permanent place in the publications of the two societies which joined in the committee of administration.

The Secretary of War in 1839 solicited from J. N. Nicollet an essay on meteorological observations. This was published by the War Department early in the same year as a circular of the Bureau of Topographical Engineers.

The prefatory note stated that the essay had been printed for distribution to those officers whose duty it might be to make observations on the phenomena of which it treats, and for the benefit of others whose tastes and situations might induce them voluntarily to aid the cause of science and the useful arts. It was noted that the observations made by officers of the corps were to be forwarded regularly, and that those made by voluntary observers would be received with pleasure. Despite this promise of meteorological activity nothing seems to have been done by the engineers for almost twenty years. This corps began the survey of the northern and northwestern lakes in 1841, but meteorological observation in connection therewith received little consideration at first. In 1857 Capt. George G. Meade in his report recommended the observation of meteorological phenomena over the whole lake region. This recommendation was approved and instruments were ordered in sufficient quantity to equip each station with a barometer, thermometer, psychrometer, rain and wind gauge. Three stations were established on Lake Ontario, 4 on Lake Erie, 5 on Lake Huron, 3 on Lake Michigan, and 4 on Lake Superior. The observations began July 1, 1859, and were recorded and in some instances discussed in the annual reports of the Survey. As a result of an agreement with the Signal Service the series ended in 1872 as a duty of the Engineer Corps, with the exception of three stations which were kept in operation to 1876.

In the introduction to the last volume of the Army Meteorological Register the statement is made that Ohio instituted a State system of weather observation in 1842. No further information is to be found as to the action of the State government, if any; but the statement finds a certain amount of confirmation in the fact that in 1843 five stations of observation were inaugurated in the State. Since very few stations had been opened prior to that date and at no period so many in one year, a certain preconcert is evident.

The Patent Office was the next department of Government to manifest interest in the recording of climatic phenomena. The seeming inconsistency of this with the more legitimate objects of the office disappears when it is remembered that at that time agriculture formed a division of the Patent Office. In the early reports of this office occur brief memoranda of notable weather phenomena which exerted a greater or less influence upon the crops then under investigation. Year by year these memoranda became fuller, and in 1847 they took the form of tabulated data for one or more years from different stations. In 1854 this series of reports contained Blodgett's essay on the "Agricultural Climatology of the United States;" from 1855 to 1859, inclusive, they contained, in five annual installments, Joseph Henry's contribution entitled "Meteorology in its Connection with Agriculture." In 1860 the Commissioner of Patents sent to the Senate a volume of results of meteorological observations made under the direction of the Patent Office and the Smithsonian Institution for the years 1854–'59, inclusive.

In 1849 the State of Massachusetts inaugurated a series of observations under State direction, which in the next year was merged in the Smithsonian system.

The Smithsonian Institution in 1849 began its great work in the field of American meteorology along several parallel lines of research, which appear topically as record of observations, publication of material aids to meteorological study, and forecast of approaching weather conditions. As a bureau of record the Institution, under the direction of Joseph Henry, gathered up from all sources past records of observations, assisted the few systems of observations then in existence, and instituted its own system throughout the country. Before this time the records, if published at all, appeared in most cases without corrections or reductions, and very rarely were they discussed. But the Smithsonian was in a better position than any other organization to give the rapidly accumulating data scientific treatment, and for that reason the data of other systems were at first sent to the Institution for examination, as was the case with the Patent Office series, and by natural growth the individuality of the several independent series was, for greater convenience, merged in the Smithsonian. Thus it came about that in 1870 this great Institution controlled all the meteorological records of the country.

Next in order of time, the Signal Service, in its capacity as a depository of records, should be mentioned, but as its meteorological duties were expressly undertaken to facilitate weather predictions, its consideration will be deferred until it naturally arises in that branch of the inquiry.

There yet remains one other series of records to examine—those maintained by the Coast Survey. It has already been shown that Bache was a leading and enthusiastic member of the joint committee which instituted the Pennsylvanian system of observations. That interest he infused into the Survey of which he was chief, and the results, though not voluminous, are valuable. In the annual reports of this Survey there appeared, in three parts, Ferrel's "Meteorological Researches for the Use of the Coast Pilot;" in the report for 1875, Appendix 20, "On the Mechanics and General Motions of the Atmosphere;" in the report for 1878, Appendix 10, "On Cyclones, Tornadoes, and Waterspouts;" in the report for 1881, Appendix 10, "Barometric Hypsometry, and the Reduction of the Barometer to Sea Level." The Survey's Pacific Coast Pilot contained, in 1879, an appendix in which Dr. William H. Dall collated and reduced all meteorological observations which had been made from the earliest times in Alaska and the Bering Sea region, subjoining to the tabulated data some discussion of the phenomena noticed. The publication is a most important contribution to the knowledge of this remote district of the country.

Rain Gauge and Support.

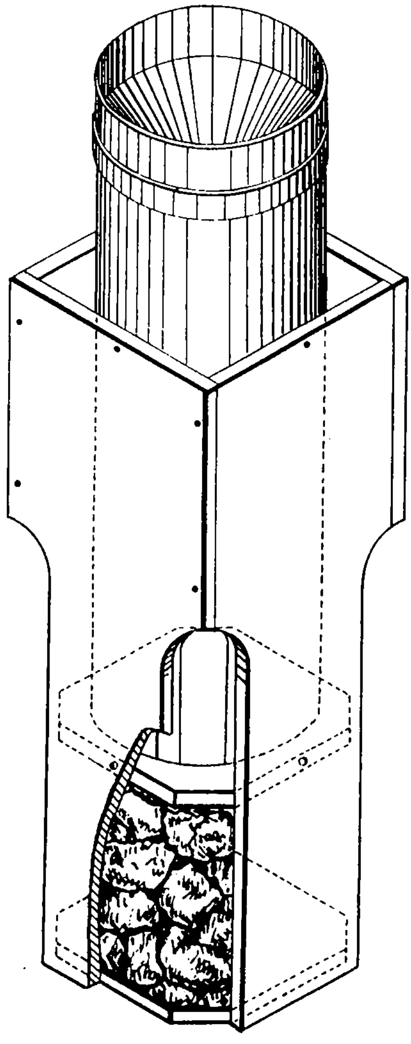
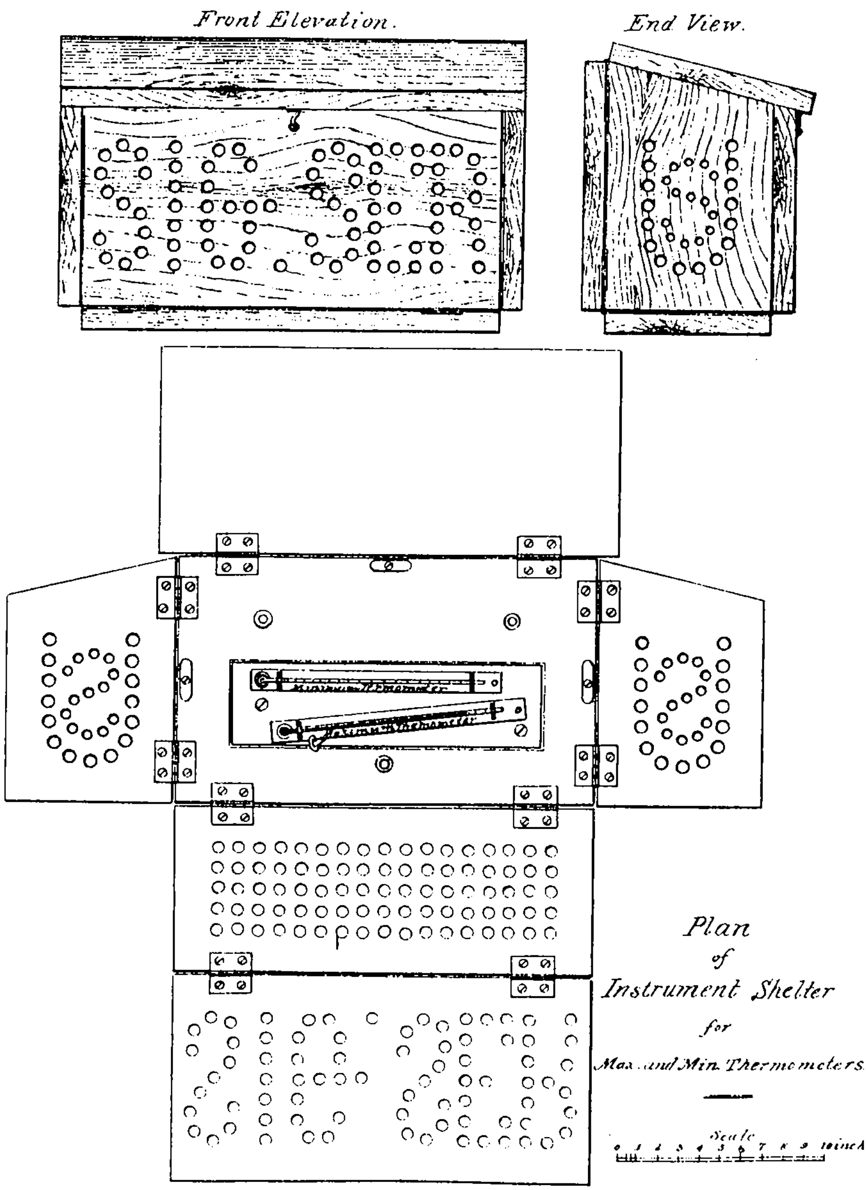


Chart No. 1—Appendix 8.
Chief Signal Officer.



Plan of Instrument Shelter for Max. and Min. Thermometers.

In passing to the second great period of American meteorology, that in which the skilled labors of the makers of verifiable forecasts have developed practical utility out of the mass of accumulated data, it is of interest to remark that this latest development of modern meteorology was the very first aim of the first students of the aspect of the sky. The folk proverbs are full of predictions of what the weather is to be. No more than forty years from the invention of the barometer the Royal Society was informed in 1685 of the pitch of knowledge to which the learned Dr. Goad, of London, had arrived in predicting the weather. At the same time it was recognized that the results of observations were an essential preliminary, and for two centuries the study of the weather was narrowly restricted to record and the preservation of materials for study.

While systematic meteorology under State aid confined itself most strictly to the sphere of preserving a record of observations, private investigation undertook the study of the physics of the weather with particular reference to the law of storms. Franklin seems to have led this line of research, for he is on record in 1747 as having deduced from such observations as were available the fact that the northeast storms were generated in the southwest. But it was not until the fourth decade of this century that the formative period of American meteorology may be said to have begun.

William C. Redfield was the first in the field. In 1831 he published his conclusions that a storm was a great whirlwind rotating from right to left about an advancing center. In 1846 he was the first to appreciate the position of cold waves in reference to advancing storm centers.

James P. Espy was contemporary with Redfield. He has been mentioned already as chairman in 1834 of the joint committee which instituted Pennsylvanian meteorology. The recognition of his theory, which failed in this country, he secured abroad by his paper "On Storms," read before the British Association in 1840. The conclusions at which he finally arrived were that storms sweep across the country from west to east; that they possess a medial axis of low pressure, generally extending north and south, with the central minimum on the middle of the axis: that the winds flow toward the axis from either side, with a tendency toward the center.

Charles Tracy, in 1843, examined the conflict then at its height between Redfield and Espy. Although Tracy's paper "On the Rotary Action of Storms" was his single contribution to meteorology, it deserves high place because it anticipated many of the best results of later investigators.

William Ferrel, since professor of meteorology in the Signal Service, was the first to apply mathematical methods to the solution of meteorological problems, in which he has covered the whole range of mathematical and physical meteorology with the sole exception of electricity. His explanation of the general planetary circulation of the winds is considered his greatest discovery, and this Newton of meteorology has until lately been connected with the Army Signal Office.

James Henry Coffin is first recorded in meteorology as one of the observers of the academic system of the New York regents in 1839. At a later period he reduced the observations which were published in the great volume of the Patent Office in 1861. His great work is the treatise on the winds.

Elias Loomis was a student at Yale when Redfield's first paper appeared. He held a tutorship in the same college when Espy propounded his rival theory. The consequent discussions he followed with characteristically grave interest, and from that time to the last day of his life meteorology held the first place in his thought and work. In addition to the preparation of the standard text book of meteorology and the valuable series of contributions, he was the first to form the weather maps now so common. It was in 1842 that the first map appeared with lines of equal pressure and temperature, wind direction, and areas of precipitation.

The telegraph transformed meteorology, made it possible to make daily test of the theories advanced by these physical investigators, and created the science of forecasting, which from the earliest times had been the aim of all weather watchers.

The first to recognize the great field of practical work just opening was Lieut. Maury, of the National Observatory. He was no novice in meteorological research. In 1833 he had examined into the causation of the prevalent low barometer off Cape Horn; in 1840 he announced his intention to study the storms and winds, and there appeared soon after his Physical Geography of the Sea and its Meteorology, while his services to navigation by the wind and current charts can never be too highly estimated. In 1851 he originated the plan of what he named farmers' meteorology, on the plan of his hydrographic logs, by enlisting the service of farmers throughout the country to report weather observations.

Two years later he assembled a meteorological congress of maritime nations at Brussels, and recommended the institution of a coördinated series of international observations by land and sea. In 1855 he addressed many agricultural societies of the South and West on this topic, and urged them to memorialize Congress to establish a central office where weather reports might be digested and telegraphed to all parts of the country, warning farmers of the approach of storms and frosts. Several bills looking toward the accomplishment of this end were presented in Congress in the session of 1857, and favorably mentioned by the Senate Committee on Agriculture in an exhaustive report by Mr. Harlan, December 18, 1856 (Senate Rep. Com. No. 292, Thirty-fourth Congress, third session). Other influences prevailed, the bill failed to pass, and before Lieut. Maury could secure the establishment of his system the nation had passed into the turmoil of a civil war.

The Smithsonian Institution early recognized the possibilities of the telegraph and in 1856 it made practical application of the simultaneous weather reports received by wire, and maintained a daily weather map at the Institution. The first attempt at published prediction seems to have been in 1858; it is found in Prof. Henry's statement to the American Academy that when the map showed rain at Cincinnati in the morning it was considered an indication of rain at Washington in the evening sufficiently trustworthy to warrant postponing the lectures at the Institution. The war interfered with the development of the plans of Prof. Henry, and when he was about to resume in 1865 the disastrous fire at the Institution crippled the resources at his command.

The idea thus by unfortunate circumstances forced into neglect was revived by Prof. Cleveland Abbe, since and now professor of meteorology, Signal Service, at that time director of the Cincinnati observatory. In 1868 he succeeded in interesting the Chamber of Commerce of that city in the project of daily predictions of the weather, and under its auspices began to issue the "Weather Bulletin of the Cincinnati observatory," which lasted from September, 1869, to January, 1871, when he was summoned to Washington to assist in the formation of the forecasting service recently assigned to the Signal Corps.

Here begins the long period in which American systematic meteorology has been embodied in the Signal Service.

The initial impulse which led the Federal Government to assume this work of public utility was given by Dr. Increase A. Lapham, of Milwaukee. Having had his attention particularly directed to the destructive gales of Lake Michigan, he had studied the early movements of the storm centers with the result that he convinced himself of the feasibility of predicting their oncoming to the great benefit of lake navigation. In 1869 he was able to convince the National Board of Trade of the value of his suggestion, and in December of the same year he addressed a memorial to Gen. Halbert E. Paine, member of Congress for Milwaukee, setting forth the possibilities of the plan and confirming its commercial importance by a list of 1,914 lake disasters caused by sudden and unannounced storms. Gen. Paine introduced a resolution embodying these suggestions, December 16, 1869, and secured the favorable indorsement of the three great authorities on meteorology, the Surgeon-General of the Army, the Secretary of the Smithsonian Institution, and Prof. Elias Loomis, and in addition the assurance of General Myer, Chief Signal Officer, that it was quite possible to report and foreannounce storms by telegraph and signal. The resolution was passed and approved February 9, 1870, and thus was created the Meteorological Bureau of the Signal Corps.

The new service went into operation November 1, 1870, with stations fully established, and has been maintained without interruption. Dr. Lapham was called in frequent consultation with General Myer in establishing the novel system and was pressed to take the position of senior civil assistant, but he felt physically unable to undertake the arduous duties, and the position was filled by his friend and correspondent Prof. Abbe.

It is seen that the purpose of the Weather Bureau of the Signal Service as originally defined was the warning of storms upon the northern lakes and eastern seaboard. By a natural extension it became a bureau of record as well, for the reports of its special observers were filed in the central office. In 1872 and again in 1873 its scope was considerably increased by acts of Congress, and in the latter year was instituted the publication of the Monthly Weather Review which was the first attempt in this country to present meteorological data to the general attention of students with the least interval after the occurrence of the phenomena discussed. In 1874 the new Bureau had given such satisfactory proof of its success and such promise of its permanence that the Smithsonian Institution transferred to it all the material collected in a long series of years under that system. From that time the Signal Service, in addition to its forecasting functions, has developed into the most comprehensive bureau of record. Its well-ordered files contain almost the entire mass of observations taken from the earliest times, and additions are constantly made.

The sources of supply are the following: Observations made with the most accurate instruments at the regular stations of the Signal Service; observations of the post-hospital system, made by order of the Surgeon-General; observations of the voluntary system. The Signal Service observers send the more important observations to the central office by telegraph for use in preparation of the daily weather maps; the full records are filed monthly and form the basis of the discussion of finer points in meteorology. The post hospitals and the voluntary observers make monthly reports of temperature and precipitation. Contributions to oceanic meteorology in connection with the international system of observations are made by a considerable number of masters of American vessels. Of all these sources of meteorological material the greater increase has been made in the lists of voluntary observers. Their equipment consists of a maximum and minimum thermometer and rain gauge, which are supplied on a personal bond. A large section of this system is due to the efforts of several railways which maintain observations for this service at many of their stations; this is particularly the case in the West. But by far the larger number of the voluntary observers are to be found on well-kept farms, distributed as evenly as possible throughout the country, and in the smaller cities wherever is found any person who feels interest in this line of research. The growth of the system is well illustrated by its extent at several periods in the history of the Service. In no one particular is the development of the meteorological service better exhibited than in the system which has secured the voluntary coöperation of the people. It has been within the power of the Signal Service to establish and maintain a considerable number of stations of observation, but in comparison with the great extent of country this number is small. In the spaces, always of great extent, between adjacent signal stations reliance has been placed upon those observers who earnestly record their observations of local climate, and who have always generously forwarded their records to this office and found satisfaction for their pains in the knowledge that they have rendered an important contribution to the proper study of the weather.

At the time the Signal Corps was installed in the performance of meteorological functions the Smithsonian Institution was maintaining a system of voluntary observers, which was soon after transferred to the Signal Corps. In 1870 the Smithsonian received reports from 492 such observers, and the Surgeon-General of the Army received meteorogical records from 102 military posts. The value of this coöperation was not immediately recognized in the first plans for extending the scope of the bureau, in fact its value was so little appreciated during two administrations of the corps that slight effort, if any, was made to maintain its efficiency and no effort at all was made to extend it. At the end of Gen. Myer's administration the voluntary system had fallen off to just half its former proportions; in July, 1880, there were but 245 voluntary observers and the post surgeons' reports amounted to no more than 65, showing almost the same proportion of falling off as the volunteer system. Shortly after the end of Gen. Hazen's administration, in July, 1887, there were 295 voluntary observers, 23 stations of State weather services, and 60 reports from post hospitals, a slight decline in the Surgeon-General's system, and an increase in the volunteer system of no more than 73 as the result of seven years application.

During the four years just ended the value of this service has been recognized as never before and the system has been carried to an extent and brought to a perfection which are the admiration of other meteorological bureaus. The tabular view which appears in this report will show how the system has been extended during the past year; the sums alone are here presented in record of but four years of steady application.

In seventeen years the number of reporting post surgeons had declined from 102 to 60. Four years of the earnest interest of the Chief Signal Officer have brought that number up to 112 out of a total of 116 garrisoned posts. The rapid extension of the great transcontinental trunk lines of railway, particularly in the West, has enabled the Chief Signal Officer to create an entirely new department of voluntary observation, and there are now 191 railway stations recording and reporting climatic data. But the greatest development is to be seen in the volunteer system which for purposes of comparison should include the railway system. With this inclusion the voluntary system now amounts to 1,916 stations. In the preceeding seventeen years the system had declined from 492 to 318, or at the general rate of nearly 4 per cent per annum. Since 1887 the system has made the simply astounding progress from 318 to 1,916, or at the general rate of 150 per cent per annum.

In closing this report I desire to acknowledge the fidelity and intelligence of the clerks of the division to whom is due, in a great measure, the important results accomplished during the year.

Respectfully submitted.

W. A. GLASSFORD,
First Lieutenant Signal Corps, Signal Officer.

APPENDIX 9.

FAREWELL ORDER OF THE CHIEF SIGNAL OFFICER.

GENERAL ORDERS } No. 25. } SIGNAL OFFICE, WAR DEPARTMENT, *Washington City, June 30, 1891.*

By operation of the act of Congress approved October 1, 1890, the Signal Corps of the Army is this day reduced from 500 enlisted men to an authorized force of 50 sergeants, and the civic duties growing out of the joint resolution approved February 9, 1870, are permanently divorced from this bureau of the War Department.

In extending to those who have served under him as enlisted men his wishes for their prosperity in another branch of the public service, the Chief Signal Officer can not refrain from expressing in orders his high appreciation of their services, ability, and character.

The varied duties of the Signal Corps have brought the present Chief Signal Officer, while serving as a subordinate, into unusually close relations with its enlisted force in almost every section of the continent, from the valley of the Rio Grande to the plains of Dakota and Montana, and in the dreary wastes of the Polar regions. Such conditions necessarily develop the character of men, and under these adverse and trying circumstances the enlisted force has invariably performed its duties with rare efficiency and fidelity; and it is with great regret that now, after over twenty years' service, covering the prime of his manhood, the Chief Signal Officer severs his official relation with a branch of the Signal Corps which has been charged with duties always entailing responsibility and anxiety, fraught often with danger and hardship, and which have proved to be of benefit to the country and an honor to the Army.

The length of service of enlisted observers is equally creditable to subordinates and officers. The observers in charge of stations have served an average of thirteen years. The very high standing of the enlisted men is illustrated by the fact that 36 per cent had received some collegiate training. No less than twenty-three men of the Signal Corps have risen to a commission in the Army; others are now lawyers, physicians, college professors, or men of high commercial standing, and of these many acknowledge the benefit of their enlisted service.

It has been erroneously supposed by many that enlistment in the Signal Corps stood for easy duty in cities, regular hours of work, and abundant leisure; as a matter of fact no other men in the Army, or indeed in any branch of the public service, have worked so continuously, served at as remote and unhealthy stations, or been taxed with such confining duties. The majority of the stations have but one observer, and it can be truly said that the weather service has been one without holidays or the usual rest on Sunday, although the work on that day is reduced to the lowest limit.

While conditions of peace have for years permitted the proper and judicious withdrawal of troops from disease-stricken districts, the Signal Service has maintained its series of meteorological observations unbroken during the time of pestilence through the heroic service of its observers, of whom some have sacrificed their lives in devotion to duty in the interest of science. In twenty years only two or three men have made sign of complaint, and, in addition to ordinary service to the Government, the men of the Signal Corps have, in more than one instance, received the highest commendations from local authorities for their gratuitous service to fever-stricken communities.

The courage, fidelity, and intelligent action of the observers of the Signal Corps charged with the repair and maintenance of telegraph lines in the Indian countries during time of actual hostilities have been acknowledged in complimentary terms by their commanding general for valuable services in the field. Equal fidelity and intelligence have marked the services of the observers serving on the seacoast lines, where devotion to duty under trying circumstances has insured the rescue of shipwrecked persons and the saving of valuable property. So efficient have been these services as to elicit at times official commendation of other branches of the Government.

The Chief Signal Officer knows and fully appreciates the assiduous and invaluable coöperation of the officers of the Army, whose labors in organizing, developing, and operating the meteorological work of this service will never be adequately stated or generally recognized. It is, however, a matter of record that the meteorological system devised by officers of the United States Army has proved to be the most successful service in the world, has served as a working model and example for other nations, while its unique exhibits have elicted unparalleled commendation. The records of officers who have participated in the work of this service for any prolonged period show the native ability and special adaptability of Army officers ordered to scientific duty for which they had not been educated and which more than one accepted with reluctance.

The Signal Corps collects and distributes an unequaled amount of weather data. In accuracy of collation, in speed of collection from and distribution to distant points, in extent, and in legibility even of its ephemeral publications the service is not only unrivaled, but is not even approached by any other weather service in the world. In attaining this practical excellence many peculiar methods of work and a large number of special mechanical devices were essential to the present success, and the Chief Signal Officer would be wanting in justice did he not acknowledge that far the greater part of these improvements is due to ideas, suggestions, and inventions of the enlisted men.

In parting from the civil employés the Chief Signal Officer feels assured that the new chief in another department will receive from them the same loyal, faithful, and efficient service they have rendered the Government while serving under his orders. The scientific staff have in view important additional duties looking to the extension of the Weather Service in the interests of agriculture and still further development of the science of meteorology. The Chief Signal Officer will follow with deep interest the development on new scientific lines of weather forecasting and the application of meteorology to agriculture, on which grounds this liberal reorganization of the Weather Bureau was planned and carried out.

A. W. GREELY,
Chief Signal Officer.

APPENDIX 10.

REPORT OF ASSISTANT PROFESSOR IN CHARGE OF THE INSTRUMENT DIVISION.

SIGNAL OFFICE, WAR DEPARTMENT,
Washington City, June 30, 1891.

SIR: I have the honor to submit the following report respecting the progress of the work of the instrument division and its present condition for the fiscal year ending June 30, 1891.

No changes have been made in either the personnel of the division or in the general routine of duties coming under its supervision.

The progress of the work has been marked with even greater promptness and precision than at any time since the reorganization of the division in 1888. The cause for this is to be found, no doubt, in not only the improved condition and general equipment of the division itself, as well as a bettered status as regards instruments of the stations under its control, but also in an increased efficiency of those employed, acquired by greater familiarity and increased experience with many details that were at first new to all.

The general functions of the division pertain to the supervision and direction of all matters relating to instruments, their designing, selection, issue, exposure, repair, etc. This division has also been charged with various original experimental researches and studies.

The coördination of the work embraced under the first class above has proved itself to be a wise and judicious arrangement, avoiding great complication and loss of time from subdivision of responsibility.

The greater part of the correspondence conducted by this division has been with observers relative to the supply of station instruments; the proper exposure of instruments upon the roofs of the new office buildings; the adjustment and maintenance of self-recording instruments, etc. Additional correspondence has been had with dealers and manufacturers relative to the purchase of new supplies of meteorological instruments, etc. It has been a general rule, with only occasional exceptions, to promptly answer every letter of inquiry upon the day of its receipt. The total number of letters sent out by this division during the past year is 2,166; an increase of about 30 per cent over the number written during the preceding year.

The shipment of instruments by railway mail has been successfully continued during the year and the service is under renewed obligations to the postal clerks and postmasters who have handled the packages so carefully. Of the 1,067 packages and boxes containing delicate meteorological instruments shipped to all parts of the United States, only one or two instances have been reported where instruments have been received in a broken or damaged condition. It is greatly to be regretted that so favorable a comment can not be made in respect to freight and express agents. Even in the limited number of shipments by these means of more or less delicate instruments, which, by their size or weight can not be sent by mail, serious and seemingly wholly unnecessary damages often occur, notwithstanding that more than ordinary care is taken in packing, etc.

STATIONS AND THEIR EQUIPMENT.

The plans inaugurated some years since looking to the more effectual improvement of stations and their equipment have been actively carried on and developed as far as circumstances would permit. The excellence of the exposure of instruments at stations moving into new buildings is a matter of serious concern to this division, and no effort is spared to secure the best possible conditions. In various cases, however, indifferent exposures only are possible owing to the ill-suited roofs of office buildings and the interference of towers or other adjacent structures.

The policy inaugurated last year of making combined wind-vane and anemometer supports from the ordinary wind-vane support, by the addition of an improved anemometer swivel-cross arm and iron steps, has been continued and about thirty additional stations are now supplied with this combined support.

The furnishing of more important stations with special instrument stands and battery cases, as also with the improved barometer cases inaugurated a year ago, was continued during the year; 50 instrument stands and 50 barometer boxes being issued. Of the latter, 60 barometer boxes were issued the preceding year, making the total number of stations supplied at this date 110 in all.

In continuation of the establishment of stations operating self-registering instruments there were issued during the past year 19 new double registers, 9 new triple registers, 24 thermographs, and 26 barographs. These, taken in connection with instruments already in use at various stations, have largely increased the number of centers at which the more important meteorological elements are continuously recorded. The growth of the service in this respect has been very rapid and very pronounced during the few preceding years, and it may be well to present here somewhat fully its present condition.

In the earlier history of the service the only continuously registering instrument in use was the anemometer with its register. These have always been supplied to all full-reporting stations. Maximum and minimum thermometers have also been in regular use, but these instruments, though sometimes called self-registering, are not so, strictly speaking, but simply *indicate* a maximum and minimum temperature since last setting, without reference to time.

Aside from these no self-registering instruments had been sent out, except to San Francisco, New York, and Philadelphia, which were provided with mercurial barographs, rain gauges, and, in the case of a few other cities, with an imperfect form of register for recording the wind direction.

The instruments, in most cases, were very costly and elaborate and correspondingly troublesome to maintain in successful operation, the records being subject to frequent interruption.

The station at Washington City has for many years been very fully equipped with self-registering instruments. The first organized effort, however, to establish first-order stations elsewhere was made in 1888. Forty thermographs and 5 barographs were distributed among 40 of the most important stations and active steps taken to improve upon the construction of the old form of wind-registering apparatus and to develop practical and inexpensive recording rain gauges, etc.

The following table gives the stations to which self-registering instruments have been issued during the past three years. The letters following the stations represent the meteorological elements recorded automatically at that station on or before the date at the head of the column, according to the following abbreviations:

[T=Temperature (Thermograph); P=Pressure (Barograph); W=Wind direction and velocity; R=Rainfall, and S=Sunshine.]

Stations.	Instruments issued during fiscal year ending—		
	June 30, 1889.	June 30, 1890.	June 30, 1891.
Abilene, Tex	T		P. W.
Albany, N. Y	T		P. W.
Alpena, Mich		T	P. W.
Assinniboine, Fort, Mont	T	P	W.
Atlanta, Ga	T	R	P. W.
Augusta, Ga			W.
Baker City, Oregon			T.
Baltimore, Md			R.
Bismarck, N. Dak	T. R		P. W.
Boston, Mass	T. P. W. R.		
Buffalo, N. Y	T. W. R	P. S	
Buford, Fort, N. Dak			T.
Charlotte, N. C	T		
Cheyenne, Wyo		T	
Chicago, Ill	T. P. W. R.		

Form 106 F.

CHART OF SIGNAL SERVICE STATIONS OPERATING SELF-REGISTERING INSTRUMENTS.

Stations.	Instruments issued during fiscal year ending—		
	June 30, 1889.	June 30, 1890.	June 30, 1891.
Cincinnati, Ohio	T. W. R	P. S	
Cleveland, Ohio	T. W. R	P. S	
Custer, Fort, Mont			T.
Davenport, Iowa			T. P. W.
Denver, Colo	T	P. W. R. S.	
Des Moines, Iowa			P. W. R.
Detroit, Mich	W. R	T. P. S.	
Dodge City, Kans	T. R. P	W. S.	
Duluth, Minn		T. P. W. R.	
Eastport, Me	T	P. W. R. S.	
El Paso, Tex	T		P. W.
Fort Smith, Ark			T.
Furnace Creek, Cal			T. P.
Galveston, Tex	T. R. P	W. S.	
Green Mountain, Me	T. P		
Helena, Mont		T	P. W.
Holbrook, Ariz			T.
Huron, S. Dak		T	P. W.
Indianapolis, Ind			T. P. W. R.
Jacksonville, Fla			T. P. W. R.
Jupiter, Fla	R		
Kansas City, Mo		P. W. R. S.	T.
Keeler, Cal			T.
Key West, Fla	W	R	T. P.
Knoxville, Tenn		T	W.
Lynchburg, Va		T	P. W.
Manistee, Mich			T. P. W.
Marquette, Mich	W. R		
Memphis, Tenn	T	P. W. R. S.	
Milwaukee, Wis	T		P. W. R.
Montgomery, Ala		T	
Montrose, Colo			T.
Moorhead, Minn			T. P. W.
Mt. Killington, Vt	T. P		
Mt. Washington, N. H	T. P		
Nashville, Tenn	T		P. W. R.
New Orleans, La	T. W. R.	P. S	
New York City	T. P. W. R.		
Norfolk, Va	R.	W	T. P.
North Platte, Nebr			T.
Omaha, Nebr	T. R		P. W.
Parkersburg, W. Va			T.
Philadelphia, Pa	T. P. W. R.	S	
Pittsburg, Pa	T	W. R	P.
Point Barrow, Alaska	P		
Portland, Oregon	T	P. W. R. S.	
Rapid City, S. Dak			T.
Red Bluff, Cal			T.
Rio Grande City, Tex	T		
Rochester, N. Y	T		W.
Roseburg, Oregon		T	
St. Louis, Mo	T. P. W. R	S	
St. Paul, Minn	T	P. W. R.	
St. Vincent, Minn	T		
Salt Lake City, Utah	T	P. W. R. S.	
San Diego, Cal	T	P. W. R. S.	
San Francisco, Cal	T. W. R	P. S.	
Santa Fé, N. Mex		P. W. R. S.	T.
Sault St. Marie, Mich	T		P. W.
Savannah, Ga	T. W. R	P. S	

Stations.	Instruments issued during fiscal year ending—		
	June 30, 1889.	June 30, 1890.	June 30, 1891.
Shreveport, La			T.
Sill, Fort, Okla			T.
Spokane Falls, Wash		T	P. W. R.
Tampa, Fla		R	
Titusville, Fla	T		
Toledo, Ohio	T		W.
Vicksburg, Miss			T.
Washington, D. C	T. P. W. R.	S	
Wilmington, N. C	T	W. R	P.
Winnemucca, Nev			T.
Yuma, Ariz	T		P. W

A station at which barometric pressure, temperature, wind direction, and wind velocity are continuously recorded or observed hourly, may be considered as of the first order, and, in accordance with this definition, the twenty-six stations of the above list, printed in small caps, were announced as first-order stations in General Orders, June 10, 1890.

The double and triple registers referred to in the column headed June 30, 1891, and designated by the letters W. and W. R., did not reach the stations until the latter part of the year, owing to delays required to correct defects in the instruments furnished by the contractor. While, therefore, all these instruments, with very few exceptions were in operation by the middle of June, yet the stations were not officially announced as of the first order. The stations thus entitled to rank as of the first order, though not officially so announced, are given in the table below, some recording also the additional meteorological element of rainfall indicated by the letter *r* immediately following the name of station:

Abilene, Tex.	Huron, S. Dak.	Nashville, Tenn., *r*.
Albany, N. Y.	Indianapolis, Ind., *r*.	Norfolk, Va., *r*.
Alpena, Mich.	Jacksonville, Fla., *r*.	Omaha, Nebr., *r*.
Assinniboine, Fort, Mont.	Key West, Fla., *r*.	Sault St. Marie, Mich.
Atlanta, Ga., *r*.	Knoxville, Tenn.	Spokane Falls, Wash., *r*.
Bismarck, N. Dak., *r*.	Lynchburg, Va.	Wilmington, N. C., *r*.
Davenport, Iowa.	Manistee, Mich.	Yuma, Ariz.
El Paso, Tex.	Milwaukee, Wis., *r*.	
Helena, Mont.	Moorhead, Minn.	

The chart —— displays to the eye by symbols explained thereon, the distribution of the stations included in the preceding tables.

The records from the various self-registering instruments are regularly checked and corrected where necessary by eye readings of standard instruments, and, when forwarded to this office, are critically examined by experts in this division with a view to the detection of erroneous records that may have escaped the observer, and to discover failure and imperfect action of the instruments.

INSTRUMENTS, SUPPLIES, ETC.

Purchase by lowest bid.—While the actual matter of the purchase of instruments and supplies is wholly conducted by the accounts division, yet specifications and full instructions originate and are prepared in this division. The lamentable necessity of purchasing special and complicated instruments by bids has continued to be the most serious obstacle to the prompt development of the work of this division, not only because of excessive delays on the part of indifferent contractors but because of the general inferior and defective class of goods furnished.

It is an inexorable law of trade, apparent to any thoughtful mind, that cheap work is always poor work. While the contract system of purchasing from the lowest bidder may be very satisfactory when applied to common-trade articles and supplies already made up and in stock, or at least wares of common and well-known manufacture, yet the experience of this office, without any exception, has shown that the lowest bidders in the cases of special and technical instruments, the proper construction of which is of great importance and is familiarly known to only a few instrument makers in this country, are, in nearly all cases parties new at the work and with little or no experience in the construction of high-grade apparatus.

It matters not how elaborate and rigid the specifications are made if the workman has not the *technique* and is not accustomed to handle work of the kind desired, one can no more hope to secure a satisfactory result than he could hope to secure an elegantly executed sample of penmanship from a man of only common skill in that particular. Both the neatly written sheet and the carefully finished instrument are the product of a personal and individual skill of hand, to be had only from special sources. As erasures and corrections upon a poorly written sheet, though they may correct gross errors and render the matter legible, yet serve only to add to its previous defects, so the alteration and modification of instruments originally of imperfect construction simply render the devices operative, while they detract still further from their actual worth. Elaborate specifications and instructions, well-constructed samples to work by, rigid requirements and severe penalties are alike powerless to supply the lack of skill and are inadequate to secure the desired ends. With very few exceptions the lowest bidder not only furnishes very unsatisfactory work, but in general barely comes out without serious loss on the job. If he ever bids again his price goes up, but in the mean time some other new party looks up the prices paid in the past and, if he particularly desires the work, sends in possibly a still lower bid. The consequence is we are year after year at the mercy of new workmen who have no special skill, perhaps, and are absolutely inexperienced in the particular work in hand.

A man's workmanship is just as definite and personal a thing as his signature, and since quality is of the first importance in instruments of this service, there should be some way provided for discretion and greater freedom of selection in the award of certain contracts.

Barometer repairs.—The division has still continued to fit up old barometer frames with new tubes, and no pains is spared to make these instruments of unusual excellence. These are used to replace those at stations that have by injury or otherwise become unserviceable. Eighty-one barometers have been prepared for such purposes during the year.

Mercury wastes saved.—The occasional breakage and injury of barometers on stations furnishes observers with mercury in small quantities, which is generally preserved, and which, in the many years past, has been added to from time to time and allowed to accumulate in considerable quantities, taking all stations into consideration. Without any definite knowledge as to the amount of mercury thus distributed, it was all called in to this office, and, though much of it was impure and seriously contaminated with other metals, yet simple appliances have been prepared for its purification, and between two hundred and three hundred pounds saved that was otherwise of little or no use.

The first purification of mercury is effected by chemical washings, either with dilute nitric acid or ferric chloride. It is afterwards distilled in one or another of the ordinary forms of vacuum still.

Thermometers and their comparisons.—The new thermometers purchased during the past year have been provided with aluminum backs instead of the brass ones used heretofore. The change has been a very great improvement, and is practically without additional expense. Nine hundred and twenty-two thermometers of different kinds were compared with standards during the year, and the corresponding correction cards for instrumental error made out for intervals of 10° over the range of the thermometer.

The matter of improved appliances for the artificial production of extreme cold, required in the comparison of thermometers at low temperatures, has been a subject of considerable study and one of which special mention was made in the last annual report. The imperative necessity for this apparatus in connection with the experimental determination of vapor pressures, led to a far more satisfactory solution of the troublesome problem than had even been imagined possible. This apparatus is fully described on p. ——, and is now regularly used in thermometer comparisons at low temperatures.

Issue of instruments.—The issue of all instruments of the service, except rain gauges, which are provided for elsewhere only because of their considerable bulk and less liability to injury, is made from this division. The number of such issues is covered, in the main, by the items in the table below; additional shipments of miscellaneous articles have been made from time to time involving only one or two pieces that are not given there.

Name of instrument.	Received.	Issued.
Anemometers	88	78
Barometers	63	59
Barographs	30	28
Psychrometers	43	37
Registers:		
Anemometer	28	28
Double	21	19
Triple	10	9
Thermographs	30	42
Telethermographs	------	4
Thermometers (all kinds)	1,098	1,209

Instrument record.—In view of the individuality, in a meteorological sense, of the various thermometers, barometers, and other instruments in regular use throughout the country and undergoing change from time to time, a historical record of each instrument is indispensable not only in connection with the meteorological observations themselves but from a business standpoint for the purpose of keeping track of the numerous and widely distributed instruments. The card-record system seemed to possess many advantages over the book system formerly in use, and effort was made to at once put the scheme in operation. Though somewhat later than was anticipated this was in successful operation by April 1; the actual record, however, dates back to and is complete from January 1, 1891. Each regular instrument of a kind has its individual number by which its identity is established. Two cards are made out for each, with name, number, and a brief description of each instrument. Blank spaces are provided below for statements respecting the present location of the instrument, date placed there, etc. These duplicate cards are filed separately; one, the index series, is grouped by instruments with the cards in numerical sequence, while the other series are classified by stations. In this way the group of cards for any particular station shows at a glance exactly what instruments are on hand with full particulars as to the dates of issue and the principal characteristics of the instruments themselves, while the index series of cards enables us to locate any instrument whose number is known. The necessary changes are always made in the cards at the time the changes are made in the instrument, so that the record is always up to date. At practically no additional expense a regular office desk, with its drawers of special dimensions, was made to answer both as the clerk's desk and the cabinet for the card record. The record comprises about 8,100 instruments; that is, 16,200 cards.

Repair of instruments and machine-shop work.—The remarks made respecting the purchase of instruments of lowest bidders apply with equal force to repair work upon the instruments, such as anemometers, registers, thermographs, etc., that from accidents and continued use and exposure are from time to time in need of repair.

The character of the work required is naturally of the greatest diversity, and for the faithful performance of much of it we are quite at the mercy of the contractor. It is often impossible to tell, without entirely overhauling an apparatus, whether repairs have been properly made or not.

The introduction during the few years past of the large number of special and complicated instruments, referred to in a previous part of this report, has very greatly increased the amount of work required of the machinists. Indeed, it has been impossible to give the work the same proper and prompt attention that obtains in respect to other duties of the division. As far as possible, repair work has been put out on contract, but in several respects, partly because of a real lack of knowledge on the part of the manufacturer as to exactly how our instruments should be made up and partly because of indifference as to details, so that instruments *appear* to be well repaired, such contract work has often been unsatisfactory, and our own machinists have been required to give finishing touches and attend to important, though seemingly insignificant, details that are, in fact, only fully known to those who have had a long experience with the use and construction of the special instruments of this service.

It is believed the most satisfactory results on repair work can be secured only by doing the work at this office. The much greater experience of the workmen is an important advantage.

The table below classifies the larger items of repairs made during the year:

Instruments.	Number repaired.	Instruments.	Number repaired.
Anemometers	53	Hygrographs	2
Anemometer cups, sets	47	Self-recording rain gauges	12
Anemometer registers	20	Telegraph instruments	20
Barometers	6	Telephones	40
Call boxes	34	Thermographs	12
Double registers	8	Transmitters (telephone)	23
Heliographs	26	Whirling apparatus	5

Besides the above a large amount of miscellaneous work has been done in the way of slight repairs upon clocks, instruments, typewriters, adders, stitching machines, etc.

Twenty-five wind-vane and anemometer supports, the parts of which are purchased by contract, have been assembled and properly fitted in the machine shop to suit the particular station needs, and turned over to the property clerk for shipment.

In the active development of new devices and the repeated improvements that have been made in the instruments it is very necessary to be able to do all such experimental work in our own shop where the machinists can be under our constant directions. During the past year the routine work has so much crowded the force that various valuable improvements and important devices have been set aside or been only partially developed.

Attempts to have some of this work done outside, namely, a special form of anemometer register and a prismatic compass, have been attended with such difficulties, because of the necessity of lengthy correspondence and with such long delays and slow progress, as to be very discouraging.

It seems very apparent that the growth of the work has been such that additional force is required for its prompt and efficient performance. The denial of this simply delays repairs and the progress of work having its origin in unexpected events, such as damages at stations by fires, storms, etc., and necessitates placing certain work outside the office that can be much better and more economically done by our own workmen.

On the occasion of the change, by act of Congress in 1888, of the enlisted force on duty in the Signal Office at Washington to a civil force, the two machinists were reduced in pay, notwithstanding a considerable period of enlistment and faithful service. As has been the case with other grades in this office, the compensation has been below that in other Departments of the Government, while at the same time, the standard of services and general ability are admitted to be higher. This certainly is not a just consideration for faithful services and must always occasion discontent. In view of such circumstances it appears to me my duty to urge the necessity not only of increasing the pay of the two machinists now employed, but to increase the force by the addition of a new man. The pay of the latter could be the same as that now given the machinists.

CARE OF STANDARD AND OTHER INSTRUMENTS.

The equipment of the instrument room with typical forms of self-registering instruments has, for several years, been very complete, and of late has been increased by the addition of a few new pieces. There have been in operation here for some time, two mercurial barographs, one of which records electrically at a distance, the record sheets being in the forecast division where the forecast official may have constantly before him a continuous record of the barometric changes; three electrically recording thermographs, the thermometers themselves being in the instrument shelter high above the building, while the automatic records are continuously recorded; one also in the forecast room, the record from the two others of different types being made in the instrument room. In addition to these are three different forms of self-recording rain gauges; two wind-velocity recorders, and two forms of registers of wind direction, with one or more aneroid barographs and thermographs of the Richard construction. These instruments are entirely under the care and attention of experts of this division, and their records, which are checked by frequent comparison with standard instruments, have been secured with scarcely any interruption.

The importance of the proper preservation of the instruments representing the standards of barometric pressure and of temperature is duly appreciated, and has received all necessary care. Not only this, but during the year the division was also charged with the development and construction of a normal barometer of high order. The progress and results of this work are given more fully in the special report upon the experimental work and studies of this division. (See p. --.)

With the increasing improvements in the office equipment and the importance of preventing serious deterioration in several of the standard instruments and appliances of the office, action was taken near the close of the year to have the dusty and dirty asphalt floor of the standards' room replaced by a plain but neat and more cleanly tile flooring. This, when completed, will be a great improvement.

SPECIAL AND EXPERIMENTAL STUDIES.

The more important work, properly classified under this head, engaging our attention during the past year, was the completion of the experiments begun a year ago, to determine by direct measurement the pressure of aqueous vapor at low temperatures. The results of this investigation in detail, together with the progress upon the development and construction of a Signal Service normal barometer, are made the subjects of a special report.

In the daily work of the office various instrumental defects are frequently brought to the notice of operators, and new ideas in the way of improvement are often suggested. These, as opportunity offers, are often worked up and developed into useful improvements.

It often occurs that different branches of the service have need of special devices and particular instruments, arranged to give some special indication or secure some particular data. The instrument division has been able, on various occasions, to contribute suggestions of some value in such cases. Indeed, it is considered as one of the proper and legitimate functions of the instrument division, that it should be able not only to furnish stock and ordinary instruments, but should also guide and direct the development of new devices for special purposes, with a view to combining the highest accuracy with the greatest efficiency and economy.

Verification of temperature standards.—As is well known, the Signal Service standard of temperature was established some years since by the careful comparisons of various select thermometers with the air thermometer. These comparisons extended as low as —60° F., but only two thermometers were used in the experiments below the freezing point of mercury, and these were common alcohol thermometers of the most ordinary construction and wholly unsuited as standard instruments. Moreover, the devices and facilities available at that time for the artificial production of low temperatures were very imperfect and unsatisfactory as compared with the apparatus used in the vapor pressure experiments. It therefore appears advisable to verify the present standards at low temperatures and add also other instruments of superior and more appropriate construction. This is now the more easily done, as the special appliances, in the way of air thermometers and accessories, are in most cases in the possession of the office.

It is with great pleasure that I take this opportunity to mention and emphasize the satisfaction felt with the noticeable care, industry, and ability displayed by the personnel of this division in the discharge of their particular duties. The important routine work of the division calls for a great deal of my personal attention, and only by the able and intelligent assistance rendered me by the chief clerk would it have been possible for me to find the necessary time for the special experimental studies already discussed.

C. F. MARVIN,
Assistant Professor, in charge Instrument Divison.

The CHIEF SIGNAL OFFICER.

REPORT OF VAPOR PRESSURE MEASUREMENTS AND NORMAL BAROMETER CONSTRUCTION.

(By C. F. MARVIN, *Assistant Professor, U. S. Signal Service.*)

PART I.—MAXIMUM PRESSURES OF AQUEOUS VAPOR AT LOW TEMPERATURES.

The continual presence of a greater or less quantity of vapor of water in the atmosphere and the enormous quantities of heat energy liberated upon the condensation of portions of this vapor combine to render the observation and measurement of the moisture contents of the air of very great meteorological importance. Indeed, according to some views, the energy thus available furnishes the chief supply for the enormous quantities displayed in the development and maintenance of the great storms or systems of atmospheric circulation.

Water and even ice, as well as other liquids and solids, readily give off a portion of their substance in the form of a gas, or, as it is generally termed, a vapor. This vapor exerts a certain pressure, as all other gases do, upon the walls of any vessel that may contain it, and, if confined in the presence of its liquid, the vapor will be found to have *a fixed and definite pressure depending, in general, entirely upon the temperature of the surface of the liquid or solid, as the case may be.* If the space containing the vapor be made larger, then more vapor will be given off, but the pressure will remain just the same unless the temperature changes at the same time. On the other hand, if we attempt to compress the vapor into a smaller space its pressure can not be increased as would be the case with air or a similar gas, but a portion of the vapor will go back into the liquid state, so that no change will be found in the pressure of the vapor that remains. These are well-known physical facts, but illustrate clearly what is meant by the maximum pressure of a vapor. The same thing is expressed when we say a space is saturated with a vapor. When the moisture in the air is at its maximum pressure the air, we say, is saturated. The tentative addition of more vapor would lead to a corresponding condensation, or, if the mixed air and moisture be cooled, the corresponding maximum pressure is less, and condensation must occur in this case also.

In all measurements, therefore, of the moisture contents of the air we desire to know in connection therewith the corresponding maximum pressures of water vapor. These pressures have been determined for a greater or less range of temperatures by several scientists within the past century, but the extended and elegantly executed series of observations made by M. Victor Regnault in 1844 have easily and deservedly taken precedence of all others, and the values found by him are quite universally accepted. Their principal deficiency, as applied to the meteorological observations in the United States lies in the fact that the temperature prevailing at many of the stations during the winter seasons are frequently many degrees below the lowest temperatures, viz, about -22° F., at which observations were made by Regnault. Moreover, all tabular values thus far published have been computed from empirical formulæ which in no case have accurately fitted the actual observed values, especially at temperatures below the freezing point. Probably the best results are those derived from Broch's reduction of Regnault's observations, but even in this case the tabular values at temperatures below freezing are with scarcely an exception noticeably higher than the observations.

The humidity tables of the Signal Service have, however, since 1886, been based upon these values, and Broch's formula has been used to compute new vapor pressures from -22° F. to -58°, thus extending the tables over a large range temperatures not covered by a single experiment. The determination of correct vapor pressures for this portion of the table has been the principal object of the investigations described herein.

At the temperature of melting ice the maximum pressure of aqueous vapor, expressed in the height of a mercurial column, is only 4.6 mm. and is much less for very low temperatures. Since the most practicable, if not the only feasible, method of observing these pressures is by means of a mercury manometer, the problem resolves itself into the very accurate measurement of the comparatively small difference in level of two communicating mercurial columns, the one being exposed to the pressure of the water vapor and the other and higher column having as perfect a vacuum above it as possible. In the case of Regnault's experiments at low temperatures* the arrangement of his apparatus is shown substan-

*Annales de Chemie et de Physique, Tome XI, 1844, p. 273.

tially in Fig. 1. A and B are two barometer tubes of the same internal diameter, viz, about 14 mm. dipping into the same reservoir. The tube B is filled with pure mercury and otherwise prdpared in the most careful manner as a barometer which may be compared from time to time with standards. The tube A is provided at the top with a horizontal branch having a three-way connector, or T, at a and a large bulb at C. The capacity of this latter is approximately 500 cc. The T connector is constructed of brass, into which the glass tubes are cemented with a mixture of red and white lead. This construction is, of itself, objectionable, as small leakages are almost unavoidable and a continuous glass joint would have been much better.

The water to be used in the apparatus is first strongly boiled in order to remove the dissolved air; a portion is then introduced into a small fragile glass capsule which is almost wholly filled and hermetrically sealed, presumably without any air in the vacant space. This capsule is placed inside the large bulb C. The lateral outlet at a is connected to an air pump and suitable drying tubes. After most thoroughly drying and exhausting the apparatus the pump was disconnected and the apparatus hermetrically sealed by fusion of the glass outlet tube at a. The elegant and efficient devices known as the Sprengel and Giesler pumps were neither of them known to science at the time of Regnault's experiments, and it was, therefore, impossible for him to secure in the manner described above an even approximately perfect vacuum. The remaining pressure is not definitely given, but is stated to be from 1 to 2 mm. It was, however, always accurately determined by surrounding the bulb C with finely shaved ice and measuring accurately the difference in level of the two mercurial columns in the tubes A and B. The pressure of the remaining air could then, presumably, be computed with sufficient accuracy for other temperatures. The air pressure correction being known the liberation of the water inside the apparatus is effected by heating the bulb and capsule until the expansion of the water bursts its envelope.

To observe the pressure of the water vapor at low temperatures the bulb C is placed inside a large vessel containing a freezing mixture of ice and chloride of calcium. With these substances Regnault succeeded in producing almost any desired temperature from 0° C. to —32° C. The difference in level of the two mercurial columns was measured by a cathetometer. Only three series of observations were made at low temperatures, and these presumably on different days, but no mention is made of any change in the apparatus, that is, all the observations at low temperatures, seemingly, were made with one filling of the tube A and bulb.

In undertaking to repeat and extend experiments of this kind it is first desirable to consider wherein lie the principal sources of error. These may be presented as follows:

SOURCES OF ERROR.

(1) The temperatures of the long mercurial columns in the tubes A and B can not be readily determined with much accuracy, and errors of a few tenths of a degree in this element introduce systematic errors of great importance in the results at low temperatures. Moreover, the heights of the mercurial columns in A and B are both subject to fluctuations in the barometric pressure that may cause the heights of the columns to change between the reading of the one and that of the other.

(2) The capillary depressions of the mercurial columns in the barometer tubes, even when as large as those used by Regnault, are very perceptible, and, in my own experience, are quite unequal in the two tubes, being always much greater in the tube containing the water vapor. The effect of this is to give too high a value to the vapor pressure.

(3) The correction for the remaining air in the apparatus is also uncertain, particularly for the results at low temperatures, where small errors are of great importance. It seems quite probable that a small quantity of air may have been introduced with the water, as it is very difficult to thoroughly drive out the air. It is even possible that the water absorbs some of the air it finds already in the bulb, thus lessening the correction for air pressure. Again, Regnault himself states that with the apparatus as described above it was possible to raise the temperature of the bulb even 10° to 15° C. higher than the air temperature and that of the top of the mercurial column and yet secure accurate observations. If, however, the differences of temperature were greater, distillation would set up and the water would collect in the tube A and upon the mercury. In my own experience with water in very perfect vacua it has been impossible to raise the

Fig. 1.

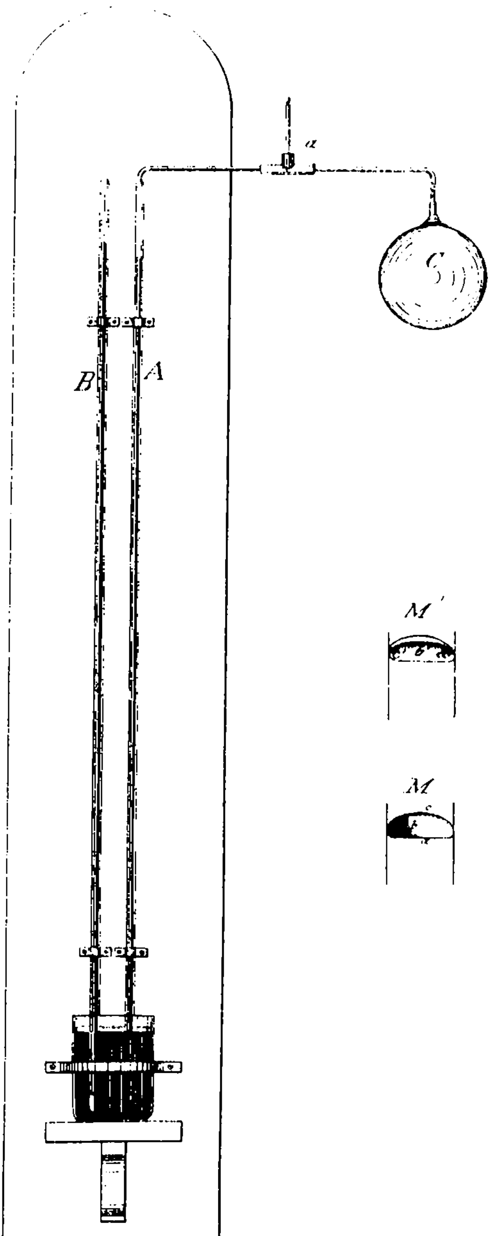
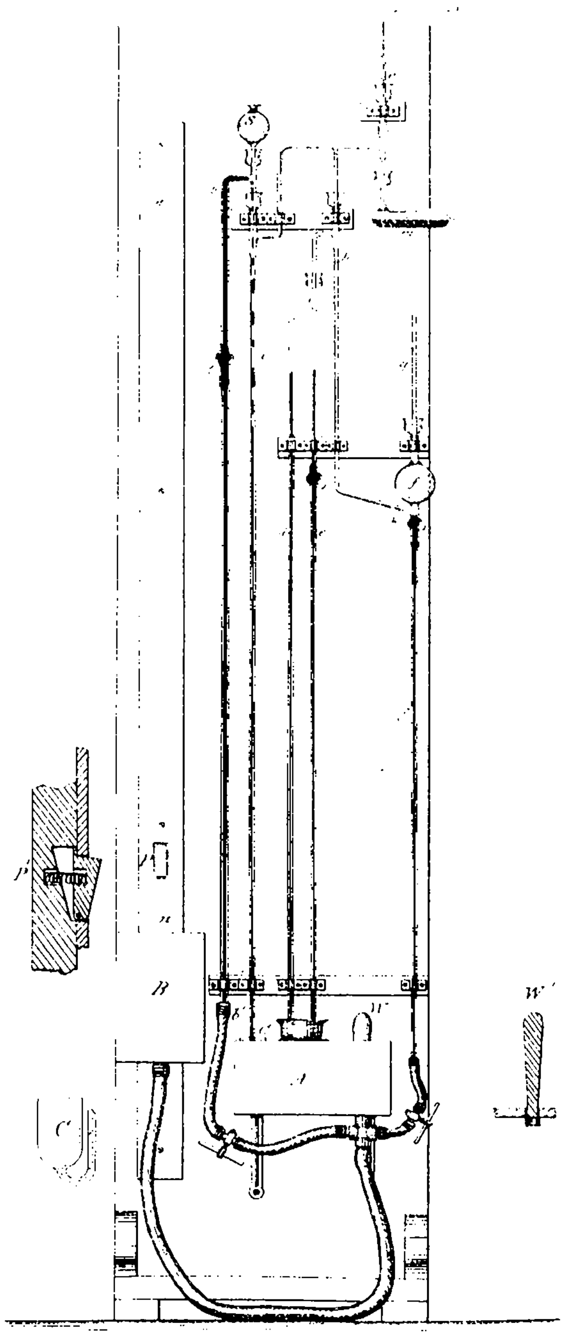


Fig. 2.



R F Sellmann del.

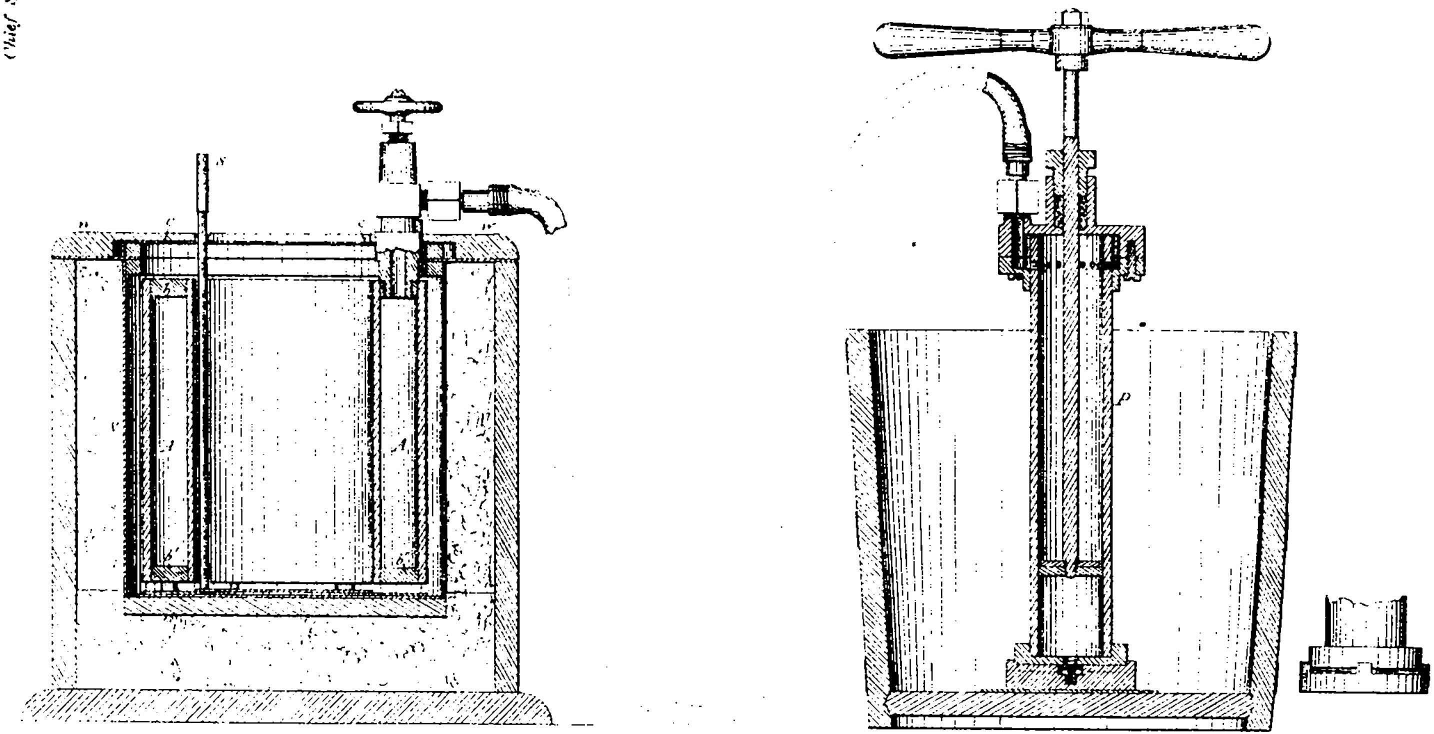


Fig. 3.

Fig. 4.

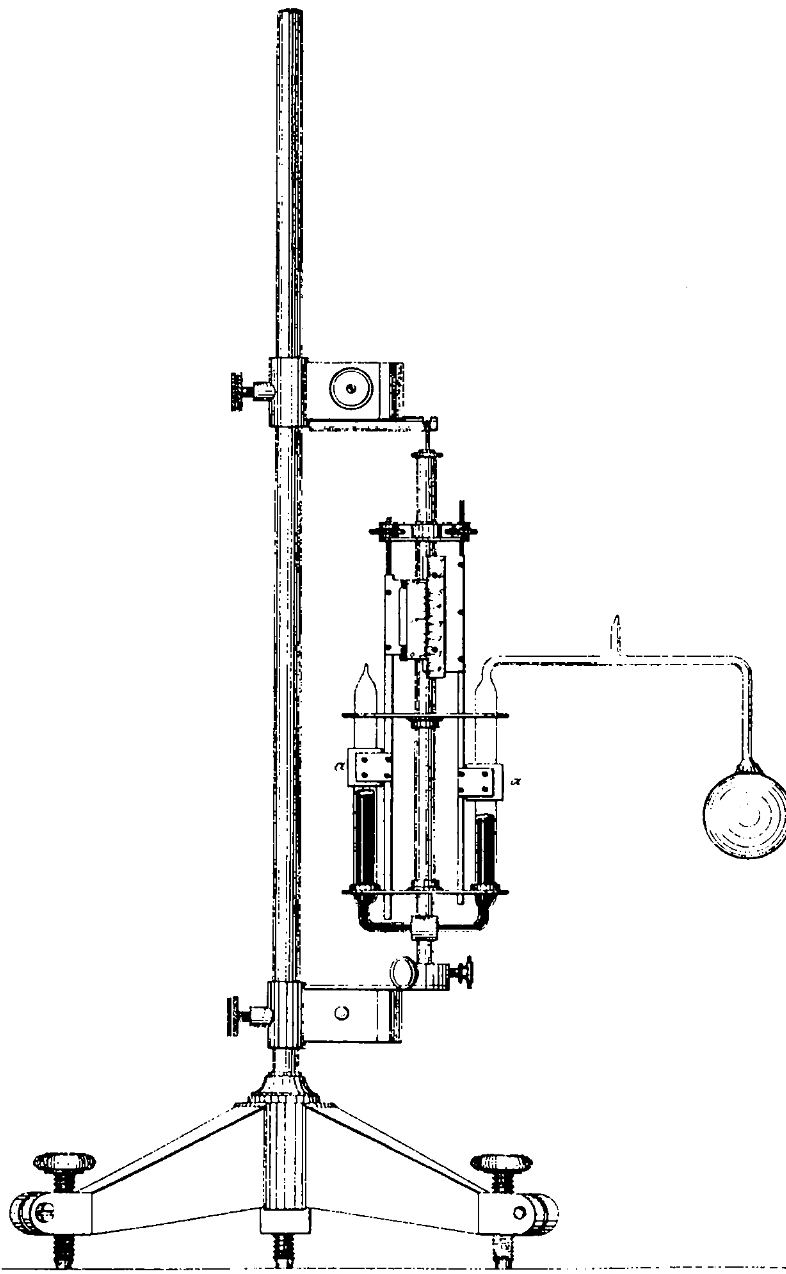


Fig. 5.

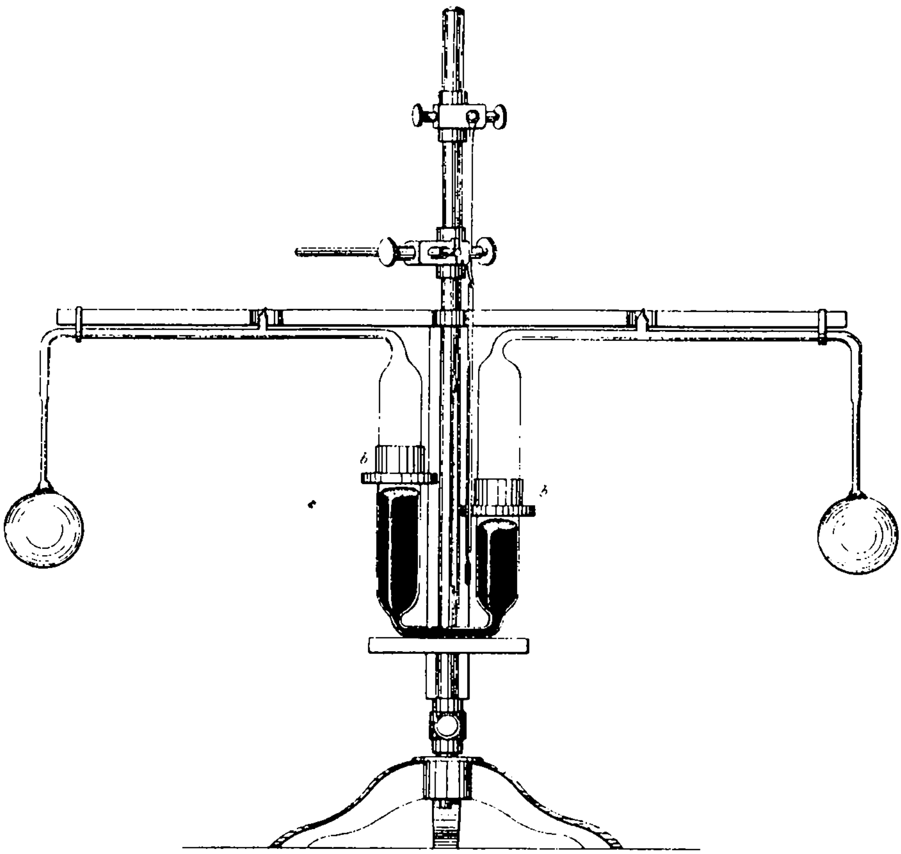
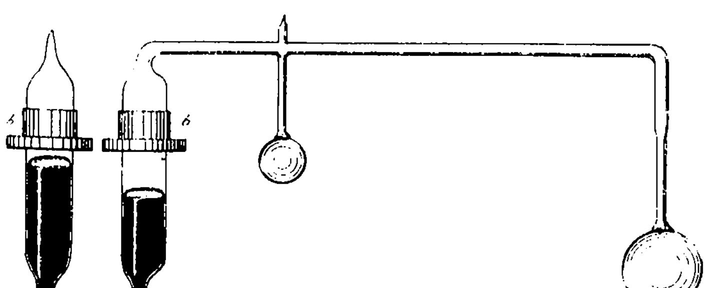


Fig. 6.



temperature of the bulb and water even a fraction of a degree above that of the mercury without distillation immediately taking place. It would appear, therefore, in the former case, that the presence of a small quantity of air prevented the free diffusion of the vapor to all parts of the apparatus, and it is quite conceivable also that a counter effect is produced upon the air, by which its density is greater in those portions of the apparatus furthest from the water. These circumstances, if they obtain, will necessitate a different air correction than would be given by the computation mentioned above.

IMPROVEMENTS.

It seems desirable and at the same time, by the aid of modern appliances, easily possible to avoid largely the above sources of error. Since we desire to measure only small pressures, the long barometric tubes may be dispensed with, substituting therefor a short U tube. This at once eliminates the effects of changing air pressure, and also removes or renders insignificant the doubtful element of the correction for the temperature of the mercurial column. Only tubes of very large internal diameter, at least not less than 25 millimeters, should be used, as only in such cases can the effects of irregular capillarity be eliminated. Finally, the vacuum in the apparatus can be made so perfect with a Sprengel pump as to make the vacuum correction sensibly zero. Special means may also be taken to very thoroughly purify the water and free it from dissolved air or other gases.

With these modifications the accuracy of the results seems limited only by the precision with which the difference in level of the two mercurial columns can be measured. In fact, a desirable degree of refinement in this direction seems scarcely attainable. The difficulty lies in exactly locating the mercurial surfaces. This difficulty may be a little more clearly understood from the following discussion. On account of the very perfect reflecting power of mercurial surfaces it results that, in general, the top of a mercurial column, when viewed horizontally, as with a cathetometer telescope, becomes itself quite invisible. The topmost portions are apt to reflect strongly light from some bright object near by, while adjacent portions of the mercury will appear dark or black. One is often deceived in respect to this appearance and imagines the curved shaded portion, which has every resemblance to the rounded mercurial meniscus, to be the real top of the column. These conditions are especially marked if effort is made to view the mercury against either a white or a black ground. In the first case the mercury will appear black, in the second white, but in neither case is the real summit of the column visible. In Fig. 1, at M, is shown an enlarged view of the top of a mercurial column. The portion on the right is illuminated and the part in shadow is seen on the left with the shaded line *a b c* between. The appearance of this when seen from the front is shown at *a' b' c'*, *b'* seeming to be the summit of the meniscus, which is itself appreciably higher and so clearly illuminated as to seem to belong to the background. A further discussion as to methods used to eliminate errors of this kind will be given in describing the apparatus.

The means of producing the low temperatures is also a matter of importance, as these must be readily under control and be practically stationary for a sufficient length of time to insure equilibrium and to permit the necessary measurements and observations to be made. The greatest difficulty was experienced in this direction and satisfactory results were obtained only after an entirely new apparatus was devised for this purpose.

Having thus referred to the fundamental conditions which we wish to satisfy in pursuing this investigation, the following descriptions of the apparatus and methods will enable one to judge of the extent to which these conditions were secured:

AUXILIARY APPARATUS.

(1) *Air pump.*—Unfortunately, dealers in physical apparatus do not carry in stock mercurial pumps, except those of the most common and inferior construction. Pumps of the Sprengel pattern, such as modified and improved by Messrs. Crooks & Gimingham,* seem to be but very little known, and are to be had only by special manufacture. Fig. 2 shows the construction of the one used in these experiments.

The fall tube *a*, of which there was but one, while Crook's pumps had as high as five, has an internal diameter of about 1^{mm} and is about 900^{mm} long. The

*Proc. Roy. Soc., 1876, xxv, p. 396.

mercury-supply tube *b*, terminated by the jet tube. has the latter ground into the enlarged portion of the top of the fall tube. This readily permits of separating the parts of the pump for cleaning or changing the character of the jet tube if the glass blower does not get it just right at first. The apparatus to be exhausted is attached to the pump at the point *c*. Much time is wasted and inferior results secured by trying to connect different pieces of apparatus with each other, or with the pump by use of rubber tubes and wax, or other cements. In working with very high vacua it is quite necessary, as far as possible, to have all parts of glass, and these in every case fused together.

The unavoidable joints in the pump are very carefully ground together, and covered with mercury and sulphuric acid also, if necessary. By the use of a special form of blast lamp, to be described later, I have found it exceedingly easy to make all sorts of fused joints in various parts of the apparatus with which I have worked. A long, slender, and comparatively flexible tube is fused to the stopper of the pump, fitting into the joint at *c*. Any apparatus to be exhausted can be easily fused to this and still be capable of slight movements. The remaining portions of the pump, shown at *d*, *e*, and *f*, are gauges used in the measurement of the pressure, *d* being an ordinary barometer tube and *e* a similar tube dipping into the same cup. The mercury rises in the latter as the vacuum becomes more and more perfect. At *f* is a McLeod gauge* for measuring the vacuum when it is very nearly perfect, and the mercury in *d* and *e* are practically at the same level. The construction and action of this gauge is as follows: The tube *g* having an internal diameter of about 2^{mm}, is closed at the top and graduated into millimeters. The branch tube *h h'* has the same internal diameter, and its upper portion, opposite *g*, is similarly graduated and numbered. The tube *g* is calibrated for irregularities in bore, and its volume per mm., very accurately determined. The volume of the entire tube *g* and the bulb *f'*, above the level of the branch at *h'*, is also carefully determined. When it is desired to measure a small vacuum, mercury is caused to flow up the tube *f*. At *h'* the flow divides, and at the same instant all the air in the bulb *f'* and above the branch *h'* is cut off from the pump and imprisoned. The flow of the mercury is continued until the bulb and part of the tube *g* are filled. The imprisoned air has been very greatly compressed, and its original quite imperceptible pressure has increased, presumably in accordance with Boyle's law, and can now be easily measured by the difference in level of the mercury in the tubes *g* and *h h'*, and which difference is easily read off by aid of the millimeter graduations.

As it is difficult, however, to originally place these graduations so that the corresponding lines are accurately on a level, it is generally necessary to determine the error in this respect by leveling across with a cathetometer or other method. The volume of the bulb and neck is about 100 c. c., and the compression can be carried to some 2,000 times. Some vacua produced by the pump have measured as low as .0004 mm., which means that the remaining gas is but little more than one part in two million of the full atmospheric pressure. Various writers express considerable confidence in the accuracy of the gauge. Its absolute indications, however, do not appear to be wholly reliable, due, perhaps, to the possible fact that during the rise of mercury and owing to the marked tendency of ordinary gases to adhere to glass surfaces, an appreciable portion of the gas is accidentally caught against the walls of the glass where it is covered over by the mercury. In consequence of this the observed pressure of the gas under compression is lower than it should be. The gas in its highly attenuated condition doubtless conforms more nearly to Boyle's law than under ordinary circumstances. To get some check upon the absolute indications of this guage I have partially prepared a direct measurement gauge consisting of the regular U manometer tubes, but filled with sulphuric acid or some nonvolatile hydrocarbon. Refined means of measuring the difference of level of the two columns can be resorted to, and it is believed valuable results secured.

At *m* is a tube partly filled with phosphoric anhydride, exposing as much surface as possible for the absorbtion of moisture. In the top of the supply tube, at *s*, is fitted a ground stopper, the top of which is formed into a small bulb. A small lateral hole drilled in the ground portion communicates with the bulb. With the stopper in its ordinary or normal position, the passage way is effectually closed in the ground joint. If, however, the stopper be raised out of its joint a very little, communication is opened through the bulb into the pump. In this way minute quantities of concentrated sulphuric acid may be admitted to the pump without in the least interfering with its action or the vacuum.

*Phil. Mag., Vol. 48, 4th series, 1874, p. 110.

The acid lubricates the fall tube, and facilitates the flow of the mercury in the most admirable manner.

The pump used in this work was constructed of the so-called lead glass, which, I believe, is not so good, by any means, as a very clear, smooth glass, which the dealers inform me is generally known as "German glass." It is comparatively soft, and stands a great amount of heating and working in the blow-pipe, a great advantage to the inexperienced, and the capillary action between it and mercury I find is most regular and satisfactory.

It only remains yet to mention the appliances used for handling and passing the mercury through the pump and gauge.

The fall tube dips into an independent cup of such construction that any acid used in lubricating the tube and passing entirely through is caught and retained in the cup, simply rising to the top of the mercury, which itself passes out through the bottom. This cup is shown by itself at C. An independent cup of mercury is also provided for the barometer tubes *d* and *e*.

The main mercury reservoir A consists of a rectangular wooden box tightly joined and holding about 25 pounds of mercury. Near the front and right-hand corner of the bottom is fitted an ordinary gas-fitter's "cross," or four-way coupling. Three of the outlets are fitted with short pieces of so-called one-quarter-inch pipe turned down a little to receive a rubber tube. The fourth outlet is larger and has screwed into it a short piece of three-eighths-inch pipe, which itself screws through the bottom of the box. The inside of this tube is flared and smoothed out so as to receive a cork *w*, which, in this case, is fitted to a long handle, as shown at *w'*. The movable mercury reservoir B is also made of wood and slides up and down on a guide piece *n*, *n*. B communicates with the box A and the pump at *b'* by strong rubber tubes, as shown, and is filled by lowering it to the lowest point of its slide. On pulling out the stopper *w* the mercury flows rapidly into B, the level of which is so arranged that B is just about filled. The bottom of the box A, however, is still well covered with mercury. By this means the surface layers of the mercury, which are nearly always more or less dusty and oxidized, are thus prevented from entering the tubes and carrying dirty mercury into the pump. Except for these surface impurities the mercury is of the best quality. After inserting the stopper *w* the box B can be raised on its guides to any desired height. At *p* is a spring catch, shown also at *p'*, which permits the box to slide over it going up and springs out to support it afterwards. The level of this catch is well within the ordinary barometric height from the highest point of the supply tube *b*. The flow of mercury through this tube, as similarly through the McLeod gauge tube, is controlled by iron stop-cocks. The junctions of rubber tubes with the glass and other parts of the pump must always be at the lowermost portions of the pump and the height of the column of mercury above the joint must always be at least a little in excess of the barometric height, thus giving an internal mercury pressure outward. If, however, the outside pressure is in excess it is very difficult to prevent slight leakages of air, which finally is likely to make its way into the pump. A check against this, however, may be provided in the well-known air trap frequently used in barometers. These are shown at *t*, *t*, *t*.

(2) *Blast lamp.*—In many of the operations of joining the different parts of the apparatus together and connecting them with the pump, it is necessary to have a special blast lamp for getting in and around the various parts. One shown in Fig. 8 was devised for this purpose and answers admirably. It is easily understood from the figure. The lamp is simply an arrangement for producing two sharp blowpipe flames which meet each other at their tips. The heating power is very great and not as concentrated as might be imagined. Normally, it rests on an iron base, as shown, and is used in almost every operation of making T and cross connectors and all other joints. With this lamp, the limited skill of the novice is not so greatly taxed in securing even heats, etc. With the base removed the stem forms a handle by which the lamp is conveniently held and manipulated about and around tubes that can not themselves be moved, easily making by this means excellent joints in almost any contracted or other position.

(3) *Low-temperature apparatus.*—The artificial production of low temperatures has long proved a troublesome problem in connection with the comparison of the large numbers of thermometers used by the Signal Service. Various expedients have been resorted to with comparatively poor results. The ordinary freezing mixtures generally do not give a sufficiently low temperature for all purposes. Moreover, they are often strongly corrosive on metals, and are always mussy, and with them it is very troublesome to produce and control satisfactorily a series of particular temperatures at which one may wish to make observations.

A partial solution of the problem was introduced by Prof. Russell in the apparatus used for the comparison of thermometers at low temperatures. This consisted of a helical coil of iron pipe immersed in a can containing nearly a gallon of alcohol. The whole was well surrounded with an outer jacket of nonconducting materials. The coil, when in use, was in communication with a flask containing liquid anhydrous ammonia, the evaporation of which in the coils of the pipe readily lowered the temperature of the alcohol to points 8° or 10° below zero Fahr. Temperatures as low as —25° could also be produced, but only with difficulty and by a very wasteful use of the ammonia.

To produce temperatures still lower than was possible with ammonia it was customary to use liquid nitrous oxide. In this case it was necessary to use a still smaller quantity of alcohol, the plan being to have two cans, one within the other with a narrow space between, the inner can containing the alcohol. The liquid nitrous oxide was passed through a tube into the space between the cans, violent ebullition taking place at first, but soon lowering the temperature, often far below any temperature desired, and always being quite beyond any sort of control; indeed, the valve passages would often suddenly become quite completely closed with dirt or frozen moisture, either from the air or from the imperfectly dried oxide, or possibly plugged by the frozen oxide itself, and again, quite as suddenly relieve itself with a great rush of liquid and gaseous matter, only to be presently throttled again. In fact, a more unsatisfactory, as well as expensive and wasteful, process can scarcely be conceived.

Liquid carbonic acid, which is now a market article, is also available for this purpose, but the peculiar property of this substance, of so readily freezing by its own evaporation, together with the very low heat conductivity of the snow of frozen acid, prove troublesome elements and are very wasteful as well. Moreover, the latent heats of fusion and evaporation together are comparatively low, and, in this sense, the carbonic acid, though pound for pound much cheaper than other liquefied gases, is, in fact, more expensive.

The apparatus shown in Fig. 3 has been found to answer all requirements in a most admirable manner, and has been used to produce temperatures as low as 65° below zero, F. Still lower temperatures, it seems, are easily obtained, though up to this time no occasion to go to lower temperatures has arisen.

The annular iron flask A is made of the best iron boiler-flue tubing, strongly fitted with the head pieces *b b'*. The outside diameter of the two tubes are respectively 6 and 9 inches, the flask being 9 inches high and containing about 1 gallon. The whole stands within a copper can, itself placed within a larger wooden jacket, the interspace being filled with cotton. A top plate, *c c*, of metal partly covers the can to which it is tightly screwed, leaving a circular opening at the center of about the same diameter as the inside of the flask A. The whole is again covered, except the opening, by a loosely fitting wooden plate, *w w*. The alcohol with which the can is filled can be stirred in a most thorough manner by means of a disk dasher, S, moving near the bottom of the can and within the iron flask. This passes the alcohol in a rapid manner from the inner portion to the outside around the iron flask and *vice versa* with the most satisfactory results.

The iron flask, by means of the screw-threaded outlet of its valve, can be joined by a very short piece of pipe to a flask of ammonia, which, in this case, must always be upside down in order to run off the liquid. If the flask A contains air, generally, only a small quantity of liquid ammonia will enter and this is best effected by opening the valves quite promptly. To further charge the flask it is first necessary to drive out the air, for which the stock ammonia flask is disconnected and a rubber tube or other outlet attached. The ammonia in the gaseous state when permitted to escape from A, carries with it the air also. The temperature of the alcohol is gradually lowered, and if an additional supply of ammonia is needed any quantity may be drawn from the supply flask out of which the ammonia will now be strongly forced by its greater vapor pressure, due to the difference of temperature of the two flasks. The ammonia gas is best disposed of by passing it into a bottle or other vessel of water, which is thus, in time, converted into excellent aqua ammonia.

One can judge of the quantity drawn off only by the sound and such circumstances. A note, however, is always kept of the weights of the stock flask, giving not only how much has been withdrawn, but its present contents as well. Between 4 and 5 pounds of ammonia are sufficient to lower the temperature to —65° and work at various intermediate temperatures for several hours. The temperature can be readily lowered to any point down to —20° F., simply using the rubber tube and water vessel. At this point, however, the escape of the ammonia gas is slow owing to its diminished pressure. The pump shown in Fig. 3 is then brought into requisition. The diameter of the barrel is nearly 3 inches and the construction is somewhat peculiar, there being but one valve. Connection with the flask A is made at the top of the pump, the communication with the inside being through the small holes near the top of the cylinder. The piston when in its highest position is above these holes. At the bottom of the cylinder is a large, flat valve closing upward with gentle pressure. From the valve way the passages to the outside are seen in the side view of this portion of the pump. The valve itself is pierced with a small hole of only about one-sixteenth inch diameter, and the whole pump is securely fastened inside a bucket or similar vessel nearly filled with water which makes its way into the pump through the small hole in the valve; in some cases of low inside pressure quite a fountain-like jet of water is formed. With the piston in its highest position the ammonia has free communication to the pump cylinder and is rapidly absorped by the water which is readily renewed by emptying the cylinder with a stroke of the piston. The absorption of the ammonia by the water is very vigorous generally, and the number of strokes of the pump necessary to dispose of a comparatively large volume of gas is correspondingly small.

The pump is remarkably effective, though when not in action the piston must be secured in a lowered position in order to prevent the rise of heated water into the tube and possibly the flask A, though the valve of the latter is generally kept closed when the gas is not being drawn off. During the escape of the gas the flask and its contents are always noticeably colder than the alcohol, so that it is easy to secure very nearly a stationary temperaure of the latter for several minutes shortly after the valve is closed.

(3) *Cathetometer.*—Except as otherwise specially mentioned all measurements of the differences in level of the mercurial columns were made with a most excellent and substantial cathetometer made some years since by the Société Genevois. The vertical bar is a cylinder, supported on sharp cones at both top and bottom. The two telescopes are each fitted with excellent micrometer eyepieces. Only one of these was used, and its micrometer screw was examined for errors, which were found so small as to be quite unimportant, and no correction for this was necessary. Except in the very first work the distance of the manometer tubes from the objective was 359 mm., and the micrometer reticule was 349 mm. from the objective. The image, therefore, is about the same size as the object.

Many determinations of the value of one division of the micrometer were made during the progress of the work, with only very slightly different results. One division corresponded almost exactly to 0.005 mm., and this could be subdivided to tenths by estimation.

The value of one division of the telescope level was nearly three seconds. The level was at all times carefully watched and sometimes recorded, but corrections for errors of this kind were always unnecessary, as the cathetometer in this respect, as in all others, has proved to be a most perfect instrument,

(4) *Standard of length.*—Two small scales have been used, both ruled by myself, upon a small divising engine made by the Société Genevois. The first of these was composed of a thin, flat, strip of German silver ruled to millimeters. The graduation errors of this scale were never determined, but are known to be only very small. The observations upon this scale, the length of which was 150 mm., were made indiscriminately upon all parts so as to avoid as far as possible errors of graduation.

The second scale was ruled upon a small, square, steel prism about 100 mm. long and nearly 5 mm. square. The errors of graduation have been determined by a calibration at each centimeter point and the fundamental length found by a careful comparison with the standard half-meter ruled for the Signal Service by Prof. William A. Rogers, the correction of which is known. These corrections prove to be quite insignificant, but have been applied. The coefficient of expansion of the German silver is taken at .0000185 per degree C.; of the steel at .0000111.

VAPOR PRESSURE TUBES.

As already mentioned under the head of improvements, the pressure apparatus is in the form of a U tube. One is shown in Fig. 6, which represents tube No. 8, so called. A vacuum of about one millionth of an atmosphere or less, as shown by the McLeod gauge, is made within the tube, the mercury is then introduced, standing level in the two branches of course, and finally the water liberated from a sealed capsule.

The tubes first made had an internal diameter of about 14 mm., but the irregular capillary action was found to give rise to such very great uncertainties in results that much larger tubes were necessary. Two of this character were constructed. The Sprengel air pump, already described, was not available at first, and some tubes were filled without it, particularly the one used by Prof. Hazen at St. Vincent, mention of which has already been made in Appendix 18, Annual Report Chief Signal Officer, 1890.

The portable measuring apparatus prepared for his use is shown in Fig. 4, except that its tube differed from the one in the drawing in that the bulb projected horizontally and backward from the top of the U, where it was joined by only a very short neck. This tube was thoroughly washed and afterwards dried by heating while being exhausted and filled many times with dry air. The entire tube was then filled with mercury drawn in through a capillary tube drawn out from the bulb. A small quantity of thoroughly boiled distilled water was next drawn in after the mercury and the capillary tube fused without the admission of any air. In this condition of affairs the problem is to draw off by means of an imperfect air pump all the mercury not needed in the tube, leaving behind it, presumably, quite a perfect vacuum, except for the presence of water vapor. This was not difficult to accomplish, and the operation is completed by fusing off the outlet for the mercury. Unfortunately this process is not capable of affording as good a vacuum as was expected of it, and several peculiar effects not as yet fully explained have shown themselves in the results.

The tube actually shown in the figure is designated No. 5 in the table of results, and gave much better values both when observed by means of the cathetometer and with the direct measurement apparatus figured, which needs but little explanation. Two sliding collars, *a a*, encircle the branches of the U, and can be adjusted by screw motion, so that their lower edges are exactly level with the top of the mercurial meniscuses. The scale and vernier reading hundredths of millimeters, give at once the difference in level of the two collars. A correction for instrumental error is carefully determined by aid of the cathetometer. This apparatus leaves little to be desired in point of method of measurement, except for the very smallest values. For vapor pressures at ordinary temperatures above freezing it seems excellently adapted. To eliminate the effects of imperfect verticality, provision is made for revolving the entire apparatus upon a fixed and definite vertical axis, thus giving opportunity to read the manometer in two positions differing 180° in azimuth. Double reading, however, was, in some cases, avoided by use of one of the cathetometer levels itself adjusted to indicate perfect verticality by revolution of the apparatus about its axis.

The manometer tubes thus far referred to were of a small size, having an internal diameter of nearly 14 mm. only. A large capillary correction, averaging .06 to .08 mm., was necessary on account of the much greater flatness of the meniscus upon the vacuum side of the apparatus; on this account the results by these tubes are less reliable, and much larger tubes were afterwards made up, as shown in Figs. 5 and 6.

As the best results can be obtained only by much care in the preparation of the apparatus, the following description is given of the processes of filling tube No. 9, Fig. 5. Similar methods were followed in the construction of tubes 5, 6, 7, and 8.

Preparation of water.—It is desired in this step to nearly fill a small capsule with pure water, perfectly free of air. The following seems to be the easiest method by which this could be effectually accomplished (see Fig. 7). A small, thin glass capsule, *a*, is joined to a bulb, B, by a slender capillary tube. The opposite portion of the capsule is drawn out into a long capillary tube which is bent into a crook, as shown. The bulb is previously nearly filled with well-boiled distilled water and a few fragments of platinum wire added to facilitate further boiling. The device is held in any convenient stand and a gas flame cautiously applied to the bulb and occasionally along the tubes and capsule. With some care and not too great haste the water can presently be made to boil readily, though throughout the whole process a somewhat violent explosion is quite probable. In fact, several have occured in my own experience, and it is therefore advisable to protect the face and eyes from possible injury by a mask of fine wire gauze. Ebullition once being set up and the steam issuing freely from the open end of the capillary tube, the latter is surrounded by a beaker of hot water into which the steam condenses as it issues, while any contained air will escape in fine bubbles. Absence of bubbles, however, is not a certain evidence of the absence of air, as the latter may be very quickly absorbed by the water. At least I have often observed an almost total absence of air bubbles and yet found appreciable amounts of air in the bulb and capsule when completed. To lessen this absorption of air it is best generally to keep the water in the beaker nearly boiling hot. After continuous boiling for half an hour or so it may be imagined the air is quite perfectly driven out and the tube may be sealed. This must be done at exactly the right moment, else some air will be admitted. The fusion of the tube can not be certainly successful until there is a partial vacuum inside. When the bulb and water have cooled a little below the boiling point and the water in the beaker has risen well up into the fine tube a sharp blowpipe flame promptly directed against the tube will instantly fuse and close it in the most perfect manner.

When cold the capillary tube can be fused off again close up to the bend at S, if not already done. To test for the presence of air in the device, turn the bulb over so that the water may cover and flow into the neck. Presently the entire capsule will be filled, with the exception, probably, of a most minute bubble, frequently so small as to quite escape detection. A sure indication of its existence, however, is given if, on turning the device over, the water flows back into the bulb. The smallest trace of air in the capsule will instantly enlarge into a visible bubble as the water flows back into the bulb. If, however, no air is present the water can not be made to flow out of the capsule even with severe shaking. It can be started only by heating cautiously, and then it starts with considerable violence.

Having by these means satisfied one's self of the absence of air, and having emptied the capsule of any water placed there, the further purification of the water, which, owing to the long boiling has doubtless dissolved some silica from the glass, is next effected by dipping the capsule into ice water; distillation at once sets up, and at a comparatively low temperature, since the evaporation from the bulb soon lowers its temperature to nearly that of the capsule. Some time will elapse before the latter is quite full of the newly distilled water. Only a small vacant space should be left in the capillary neck and the capsule fused off ready for use.

Washing.—It is advisable to always wash thoroughly the inside of the apparatus. A small quantity of strong nitric acid is first introduced, heated, and shaken about as violently as possible into every part of the apparatus. After washing this out pretty well with ordinary water a cream-like mixture of fine tissue-paper pulp with whiting and water, often with caustic potash in solution, is next shaken about thoroughly in every portion of the tubes. This material seems to put the glass surfaces into an excellent condition. Many changes of ordinary water are then passed through the tubes, followed by several changes of distilled water. The last is drained out quite thoroughly and a few charges of strong alcohol passed through. The tube is now ready to be attached to the pump for drying, etc.

The attachment of the apparatus to the pump involves the preparation for all the subsequent operations of drying, exhaustion, filling with mercury, and introduction of the water. The complete arrangement is shown in Fig. 9. The device in which the water capsule is manipulated is provided for first. A wide tube, a, is fitted at one end with a 4-way or cross connection, x; one arm of this is bent and joined by fusion to the pressure tube.

The whole affair is then laid nearly flat upon some convenient and suitable support near the air pump, a slight inclination being given it in such manner that the mercury, which will be introduced at the outlet m, may flow gently into the enlarged manometer tubes, first into the one, thence overflowing into the other, until both are partly filled, and a sufficient quantity introduced. The water capsule with its slender crooked end behind is slid up into the large portion of tube a, after which the open end is nicely closed by means of the blast lamp.

The two remaining arms of the cross x are joined respectively to the Sprengel and the ordinary air pump, the latter connection being through a tube several decimeters long, containing some soft, clean linen and cotton loosely packed. I have always had trouble in the use of rubber tubing, from the fine sulphurous dust penetrating the apparatus and seriously interfering with the purity of the mercury. The cotton strains the air and the linen further prevents shreds of cotton escaping out of the strainer tube. The rubber tubing connects first with a siphon manometer, thence, under control of a valve, with the air pump, or with drying tubes through which air may be admitted. At the outlet m is joined a small tube, as shown. The height of this is greater by several centimeters than the barometric height. To the mercury flask into which this tube dips is also connected, as shown, a small manometer and compression syringe.

These arrangements and connections being all made, we may proceed at once to dry the apparatus, which is effected by repeated exhaustions with the barrel pump, followed, in each instance, by the slow admission of dry air, and, in the mean time, strongly heating all parts with a Bunsen burner.

Two of the drying tubes used contained finely-divided anhydrous chloride of calcium; a third, concentrated sulphuric acid and pumice stone. The aggregate length of drying materials was about 1 meter.

This operation is repeated from twenty to thirty times. At last the vacuum is made as perfect as possible and the strainer tube fused off at *b*. The Sprengel is next set in action and allowed to perfect the vacuum. In general, the pump has continued in action during about two days, though at rest at night. Only after such a length of time would the vacuum show its highest value, and this would always occur long after the mercury fell with a clear metallic click, and seemingly contained or carried out no air.

The vacuum being attained, the mercury is made to flow into the pressure tubes by compressing air in the mercury bottle. The three-way valve at V permits stopping the flow at any instant, and the manometer tube always shows the excess of pressure inside the mercury bottle.

Tests have been made to see if air was introduced into the apparatus with the mercury. This has never been shown by the pressure gauge. Even had air been admitted it may still be removed by the pump.

The mercury used has always been of the best quality, purified shortly before use by washing with dilute nitric acid and afterwards distilling in a vacuum still. Its density has not been directly determined.

Liberation of the water.—There seems to be only three ways of breaking the capsule, one by heating until the expansion bursts the envelope, a second by freezing, and a third by mechanical means. For this latter purpose the capillary end of the capsule is purposely left slender and crooked, as shown in Fig. 7. When made to fall to the bottom of tube *a*, and strike upon the delicate end, the latter is quite sure to break off. This is probably the least troublesome and most certain of all the methods, and is easily effected after the communication with the air pump is cut off, by promptly raising the pressure tube to a vertical position. A small portion, generally not more than one-third, of the water in the capsule is next distilled into the bulb, which is surrounded with shaved ice. It is imagined that the purity of the water thus obtained is practically perfect. When a half cubic centimeter, or less, has distilled over, the tube *a* is fused off at *c*. For use the device is mounted in the support shown in Fig. 5.

In order to make certain that there could be no difference of level in the two mercurial columns before the water vapor was released, direct observations with the cathetometer in some cases were made before the water capsule was broken. Seeming differences of level found in this way were very small and so irregular as to prove themselves nothing more than errors of observation.

After such experiments the water capsule was generally broken by freezing, seemingly a very simple operation but in reality one that gave very much trouble, and, in some instances, resulted disastrously by the bursting of the outer vessel as well as the capsule; the sharp-pointed end of the latter being driven quite through the heavy bottom of tube *a*. This was afterwards avoided by standing the capsule on its long slender end, which had not sufficient strength in itself to pierce the outer tube and also served to break the force of the explosion of the capsule.

Various somewhat remarkable peculiarities were observed respecting the freezing of the water, but are discussed separately in a note at the end of this paper.

METHOD OF OBSERVATION.

Some reference has already been made to the correct principles of observing the top of a mercurial column; these have been realized as nearly as possible, as follows: The shade collars *b b*, at the time of observation, are adjusted very close to the top of the column. A strong white light from an adjacent window, screened by tissue paper is reflected from behind by a mirror. Such means properly arranged give in the telescope a very clear-cut image of the mercury, with a brilliant line of light above it. All light of any intensity from the front should be cut off by any convenient screens. Following such methods and with wide tubes the black shade line *a′*, *b′*, *c′*, Fig. 1, must coincide very closely with the top of the mercurial meniscuses. The aperature of the telescope is cut down by a diaphragm to about one centimeter. After some trials I have preferred to use a single cross wire in the micrometer, which is brought down to coincidence with the black mercury line. These methods of sighting admit of very excellent results, but I have endeavored to avoid the effects of small constant errors by continued readjustment of the collars between observations, placing them at slightly different distances, rarely or never exceeding one-third millimeter.

The scale, when used, hangs vertically between the two branches of the U, as does also a thermometer for indicating the air temperature about the manometer. These are seen in the drawing. Sudden changes in temperature are lessened by wholly surrounding the manometer with a box-like case made of blotting paper. Only the tops of the mercurial columns are visible. The scale may be moved up and down to bring new portions into use. Perfect illumination is indispensable. A mirror is arranged in front to render the divisions of the scale very clear. The distance of each object from the telescope is carefully adjusted by use of a slender measuring stick; the proper focal distance being determined once for all by careful adjustments. The telescope lenses are not moved at all.

For pressures at the temperature of melting ice the bulb containing the water is packed in shaved ice. The temperature is almost instantly at its minimum. The water in the bulb can not long remain at a higher temperature than the walls of the bulb because of the evaporation and distillation from the warmer to the colder spot. This effect is by no means so rapid if some air be present.

In some cases observations of the pressure at temperatures as nearly as possible at the melting point were made with the bulb in a suitable bath. Generally the values obtained in this way agreed very well with those obtained in ice, particularly in the case of the larger-sized tubes. If, however, the water in the bulb was frozen, as occurred after making observations at low temperatures, then the pressure at a temperature a trifle above the melting point was never quite as high as it should be until after all the ice in the bulb had melted. The results obtained under these circumstances, excepting, however, cases with the ice inside the bulb only partly melted, are given in Table II, immediately following the observations "in ice."

For pressures at temperatures below the freezing point the bulb is immersed in the alcohol of the low-temperature bath, the temperature of which is indicated by at least two, and sometimes more thermometers, the readings of which are made direct with the aid of a hand magnifying glass. All thermometers used have been directly compared with the Signal Service air thermometer. In the case of temperatures below the freezing point of mercury only one alcohol thermometer has been used. The adhesion of the alcohol to the walls of the thermometer tube proved very troublesome. Its indications have, however, been corrected, as follows: The alcohol thermometer was kept in the bath as the temperature was lowered. At -20° or -30° and -35° readings with the mercurial thermometers were recorded. In all cases where the low-temperature apparatus has been used observations have always been made in passing from a higher to a lower temperature and then repeated, coming from the lowest to the highest. In returning from the lowest temperature the alcohol thermometer is then again read with the mercurial thermometers at -35° and -30° F. Its official corrections are then modified as the occasion may require, to make its indications agree with the mercurials at -30° and -35°. This modification has generally been effected by aid of a curve representing the conditions.

The following extract from the original record of observations will show how the greater part of these were taken:

May 9, 1891.

Vapor pressure tube No. 8.

Time.	Air temperature, No. 1056.	Micrometer readings. Dry. Turns.	Micrometer readings. Dry. Divs.	Micrometer readings. Wet. Turns.	Micrometer readings. Wet. Divs.	Temperature of bath. No. 1503.	Temperature of bath. No. 9704.	Micrometer readings. Wet. Turns.	Micrometer readings. Wet. Divs.	Micrometer readings. Dry. Turns.	Micrometer readings. Dry. Divs.
9.52	70.0	27	5.2	13	19.9	25.03	25.13	13	22.0	27	9.3
10.00	70.3	27	9.1	13	22.3	25.10	25.20	13	22.0	27	7.4

The bath is first regulated to as nearly a stationary temperature as may be and allowed to stand a moment while the mercurial surfaces quiet themselves sufficiently to admit of observation. The readings in the first horizontal line are then made in the order recorded from left to right. The bath is again thoroughly stirred and readings taken in the reverse order from right to left. In some cases an additional complete set of readings have been immediately taken at the same temperature; generally, however, the temperature is next changed 5 degrees and similar observations taken. Each group of observations thus obtained is reduced to a mean result, which is then corrected for all instrumental errors, etc. Tables I and II, below, give the mean results thus obtained. The temperatures are in Fahrenheit units, according to the Signal Service standard air thermometer; the pressures are in millimeters of mercury at tempatures of melting ice and under normal gravity.

The column of differences exhibit the disagreement between the values found by these experiments and those given in Broch's table of Regnault's observations. It will be noticed, (1) that below 32° the observed values are, without exception lower than the tabular values; (2) that the agreement at 32° is very close; and (3) that above 32° the best results, namely, those from tubes numbers 8 and 9 are, without exception, higher than the tabular values.

TABLE I.

No. of tube.	Duration of observation.	Temperature.	Pressure.	Difference, table — observed.	Tube No. 4. Temperature.	Tube No. 4. Pressure.	Tube No. 4. Difference, table — observed.
	Min.	° *F.*	*mm.*		° *F.*	*mm.*	
8	....	80.05	26.279	—.271	82.94	28.573	—.013
8	....	79.84	26.106	—.281	....	....	....
8	....	74.65	21.957	—.213	....	....	....
8	....	75.08	22.268	—.208	....	....	....
9	14	74.93	22.171	—.217	....	....	....
8	....	69.91	18.747	—.213	68.05	17.374	+.016
8	....	69.58	18.541	—.210	....	....	....
9	17	69.88	18.732	—.209	....	....	....
8	....	64.76	15.696	—.172	66.68	16.732	—.052
8	....	64.59	15.581	—.144	65.14	15.767	—.032
9	14	64.91	15.764	—.153	63.34	14.806	—.034
8	....	59.41	12.993	—.131	62.33	14.221	+.038
8	....	59.80	13.178	—.142	59.04	12.776	—.086
8	....	59.78	13.143	—.115	58.64	12.577	—.065
9	13	59.17	12.904	—.149	....	....	....
9	18	59.99	13.246	—.118	....	....	....
8	....	54.91	11.080	—.137	56.03	11.394	—.001
8	....	55.18	11.163	—.112	55.29	11.141	—.048
8	....	55.04	11.123	—.130	....	....	....
9	33	55.23	11.151	—.079	53.33	10.334	—.004
8	....	49.22	8.947	—.065	52.00	9.838	±.000
8	....	49.86	9.154	—.063	51.39	9.488	+.125
8	....	49.87	9.153	—.056	49.46	8.858	+.101
9	21	50.09	9.239	—.069	....	....	....
8	....	44.78	7.554	—.037	46.11	7.786	+.119
8	....	44.75	7.595	—.088	....	....	....
9	17	44.94	7.614	—.051	....	....	....
8	....	39.44	6.166	—.041	....	....	....
8	....	39.68	6.256	—.071	....	....	....
8	....	40.07	6.297	—.021	....	....	....
9	18	39.70	6.217	—.028	....	....	....
8	....	34.96	5.164	—.025	....	....	....
8	....	34.95	5.171	—.032	....	....	....

TABLE II.

No. of tube.	Duration of observation.	Temperature.	Pressure.	Difference, table minus observed.
	Min.	° *F.*	*mm.*	
4		Bulb packed in ice.	4.558	+.011
4			4.595	—.026
5			4.533	+.036
5			4.562	+.007
6			4.554	+.015
7			4.586	—.017
8			4.575	—.006
8			4.580	—.011
8			4.584	—.015
9			4.566	+.003
5		31.83	4.487	+.052
5		31.30	4.373	+.069
5*	9	31.73	4.445	+.075
6		31.80	4.349	+.184
8		31.74	4.535	—.012
8	15	31.82	4.494	+.042
8	25	32.03	4.578	—.005
9	2	32.63	4.679	+.006
9	5	31.51	4.505	—.024
5		25.50	3.372	+.135
5		25.94	3.409	+.161
5*	6	24.86	3.213	+.201
6		25.84	3.438	+.119
8		25.89	3.462	+.098
8		25.96	3.477	+.096
8	13	24.90	3.237	+.185
8	7	24.85	3.298	+.116
9	14	24.99	3.298	+.134
9	14	24.70	3.243	+.148
9	5	24.78	3.310	+.094
5*	6	19.81	2.501	+.263
5		19.87	2.547	+.223
5		19.87	2.561	+.209
5		19.91	2.510	+.264
8	15	19.94	2.576	+.202
8	5	19.94	2.608	+.170
8		19.96	2.632	+.149
8		19.88	2.612	+.160
9	14	19.98	2.598	+.185
9	6	19.83	2.618	+.148
5*	5	14.74	1.945	+.277
5		14.76	1.973	+.250
5		14.93	2.005	+.236
6		14.74	1.906	+.316
8	13	14.80	1.973	+.254
8	6	14.84	2.034	+.196
8		14.94	2.046	+.195
8		15.07	2.071	+.183
9	14	14.97	2.065	+.179
9	4	14.78	2.056	+.169

*These readings on tube No. 5 were made with direct measurement apparatus (see Fig. 4).

TABLE II—Continued.

No. of tube.	Duration of observations.	Temperature.	Pressure.	Difference, table minus observed.
	Min.	° *F.*	*mm.*	
5*	7	9.46	1.463	+ .296
5*	5	9.66	1.497	+ .279
5	....	9.60	1.541	+ .231
5	....	9.93	1.572	+ .226
6	....	9.98	1.564	+ .238
8	....	9.73	1.529	+ .253
8	....	9.91	1.598	+ .198
8	18	9.94	1.544	+ .255
8	13	9.90	1.527	+ .268
8	5	10.02	1.609	+ .196
9	16	10.14	1.640	+ .174
9	14	9.95	1.619	+ .180
9	6	9.72	1.612	+ .168
5	....	4.52	1.150	+ .257
5	....	4.93	1.215	+ .219
5*	7	5.07	1.196	+ .248
5*	6	4.85	1.135	+ .295
6	....	4.80	1.192	+ .234
8	....	4.96	1.209	+ .228
8	....	5.14	1.243	+ .206
8	18	4.95	1.180	+ .255
8	15	4.85	1.209	+ .221
8	6	5.02	1.236	+ .204
8	5	4.78	1.225	+ .200
9	17	5.08	1.284	+ .160
9	21	5.08	1.261	+ .183
9	6	5.16	1.275	+ .175
4	....	− 0.15	0.962	+ .172
5	....	+ 2.94	1.087	+ .221
5	....	+ 2.05	1.042	+ .214
5	....	− 0.97	0.874	+ .217
5	....	− 0.96	0.878	+ .213
5*	7	+ 0.13	0.913	+ .235
5*	6	− 0.18	0.866	+ .266
5	....	− 1.80	0.858	+ .190
5	....	− 2.39	0.826	+ .193
6	....	− 0.29	0.903	+ .223
8	....	+ 0.08	0.977	+ .168
8	....	− 0.08	0.965	+ .172
8	14	− 0.06	0.931	+ .207
8	15	− 0.06	0.901	+ .237
8	6	+ 0.07	0.961	+ .184
8	4	− 0.09	0.963	+ .174
8	4	− 0.06	0.923	+ .215
9	18	+ 0.02	0.997	+ .145
9	18	+ 0.03	0.997	+ .146
9	5	− 0.15	0.984	+ .150
5	....	− 5.58	0.688	+ .187
5	....	− 5.36	0.699	+ .185
5*	10	− 5.04	0.678	+ .220
5*	6	− 5.31	0.651	+ .235
6	....	− 5.29	0.676	+ .211
8	....	− 4.98	0.745	+ .156
8	17	− 5.09	0.684	+ .212

*These readings on tube No. 5 were made with direct measurement apparatus (see Fig

TABLE II—Continued.

No. of tube.	Duration of observation.	Temperature.	Pressure.	Difference, table minus observed.
	Min.	° *F.*	*mm.*	
8	15	— 5.02	0.717	+ .182
8	6	— 5.16	0.721	+ .171
8	6	— 4.94	0.749	+ .154
8	5	— 5.34	0.687	+ .198
9	16	— 5.16	0.742	+ .151
9	14	— 5.27	0.737	+ .151
9	6	— 5.17	0.753	+ .139
5	----------	— 10.26	0.541	+ .154
5	----------	— 10.26	0.541	+ .154
5*	7	— 10.31	0.490	+ .204
5*	5	— 10.05	0.480	+ .223
8	----------	— 10.32	0.571	+ .122
8	----------	— 10.00	0.558	+ .147
8	5	— 10.07	0.569	+ .133
8	6	— 10.18	0.543	+ .155
8	6	— 10.16	0.522	+ .177
8	6	— 9.81	0.553	+ .158
9	15	— 10.21	0.573	+ .124
9	12	— 10.29	0.567	+ .128
9	6	— 10.28	0.578	+ .117
5*	8	— 15.34	0.378	+ .160
5*	7	— 15.06	0.364	+ .182
5	----------	— 15.16	0.407	+ .136
5	----------	— 15.16	0.407	+ .136
8	6	— 15.09	0.433	+ .112
8	8	— 14.91	0.407	+ .143
8	6	— 15.04	0.404	+ .143
8	5	— 14.90	0.410	+ .140
9	15	— 15.02	0.442	+ .105
9	18	— 14.44	0.449	+ .115
9	6	— 15.29	0.433	+ .107
5*	7	— 20.85	0.241	+ .163
5	----------	— 20.85	0.247	+ .157
5	----------	— 20.85	0.281	+ .123
5	----------	— 20.85	0.281	+ .123
8	8	— 19.96	0.312	+ .112
8	7	— 20.09	0.318	+ .103
8	7	— 20.08	0.284	+ .137
8	7	— 19.84	0.302	+ .124
8	10	— 19.63	0.323	+ .108
9	16	— 20.04	0.335	+ .087
9	21	— 20.02	0.335	+ .087
9	6	— 20.02	0.335	+ .087
9	6	— 19.91	0.336	+ .089
9	5	— 20.45	0.331	+ .082
5*	13	— 25.62	0.185	
5*	8	— 26.02	0.176	
8	9	— 25.06	0.206	
8	6	— 24.89	0.215	
8	5	— 24.94	0.246	
9	27	— 25.00	0.257	
9	22	— 25.12	0.248	
9	17	— 25.29	0.249	
9	6	— 25.37	0.253	
9	5	— 25.33	0.260	
9	4	— 25.07	0.255	

*These readings on tube No. 5 were made with direct measurement apparatus (see Fig. 4).

TABLE II—Continued.

No. of tube.	Duration of observations.	Temperature.	Pressure.	Difference, table minus observed.
	Min.	° *F.*	*mm.*	
5*	9	— 29.85	0.131	
8	9	— 30.33	0.139	
8	6	— 30.06	0.151	
8	5	— 30.73	0.169	
8	6	— 29.72	0.170	
9	23	— 29.91	0.190	
9	24	— 30.06	0.189	
9	6	— 30.28	0.190	
9	7	— 30.21	0.194	
9	5	— 29.73	0.199	
9	4	— 30.12	0.193	
5*	....	— 35.00	0.095	
8	18	— 35.24	0.097	
8	7	— 35.66	0.086	
8	6	— 34.75	0.119	
8	8	— 34.11	0.122	
9	22	— 35.03	0.144	
9	30	— 35.12	0.144	
9	7	— 34.99	0.146	
9	6	— 34.96	0.139	
9	6	— 34.84	0.153	
9	4	— 35.03	0.151	
8	....	— 41.20	0.081	
8	4	— 39.02	0.097	
8	11	— 41.51	0.061	
8	7	— 40.10	0.077	
8	....	— 42.40	0.055	
9	5	— 41.10	0.102	
9	5	— 39.55	0.116	
9	4	— 39.62	0.110	
9	5	— 39.85	0.111	
8	5	— 44.75	0.082	
8	9	— 45.30	0.049	
8	....	— 44.50	0.054	
8	....	— 47.20	0.044	
9	4	— 45.50	0.079	
9	4	— 43.50	0.086	
9	5	— 45.00	0.082	
9	6	— 45.17	0.085	
8	8	— 48.82	0.062	
8	4	— 49.78	0.056	
8	15	— 50.40	0.0045	
8	....	— 49.90	0.020	
8	....	— 52.20	0.015	
9	7	— 50.88	0.059	
9	7	— 50.00	0.062	
9	4	— 50.10	0.068	
9	6	— 49.05	0.063	
8	11	— 56.05	— 0.0005	
8	....	— 55.20	0.017	
9	4	— 55.10	0.044	
9	5	— 55.62	0.045	
9	11	— 54.70	0.050	
8	....	— 58.80	0.004	
9	6	— 60.95	0.043	

*These readings on tube No. 5 were made with direct measurement apparatus (see Fig. 4).

RESPECTIVE ACCURACY OF TUBES AND COMBINATION OF RESULTS.

The following remarks are here given to indicate, according to my knowledge, the degree of dependence that may be placed upon the results from the respective tubes:

Tubes Nos. 4, 5, and 6 were all of small dimensions; that is, the manometric columns were about 13.5 mm. diameter, and the differences in capillary action, as indicated by the unequal convexity of the mercurial meniscuses, were always great and in some instances excessive, a maximum correction of nearly 0.1 mm. having been applied. To determine these corrections the height of the capillary meniscuses were frequently measured during observations, and corrections have, in all cases, been taken from tables calculated by Delcros after the formulæ of Schleirermacher, and given in the Smithsonian meteorological and physical tables. They are confessedly unsatisfactory, but no better course appeared possible.

Tube No. 4 I consider the least reliable of any. It was filled without the aid of the Sprengel pump, and the vacuum is known to be imperfect. Very few observations were made, except above 32°, and these I regard as of little accuracy.

Tube No. 5 is the best of the small tubes, being very perfectly exhausted. Its only defect is unequal capillarity; a correction of from 0.065 to 0.110 mm. having been applied on different occasions. Without this correction the pressures would, in all cases, have been higher. In the first observations made with tube No. 5 the differences of level were measured by aid of the cathetometer. The tube was afterwards mounted in the measuring apparatus shown in Fig. 4, and a complete series of observations made. All results obtained in this way are marked with an asterisk in Table II.

Tube No. 6 was also exhausted by the Sprengel pump, but accidentally broke before observations, except at 32°, were taken.

Tube No. 7 was the first one made with large manometric columns and was constructed to show whether or not the dimensions of the bulb and parts had any effect upon the pressure of the water vapor and whether any change in the pressure could be produced by greatly heating the parts of the apparatus not immediately containing the water. The manometer tubes had an internal diameter of about 25 mm., and on one side were fitted with two bulbs much after the fashion of tube No. 8, shown in Fig. 6. The small bulb had a diameter of about 2 cm., while that of the large bulb was over 10 cm. in diameter with a capacity of over 500 c. c. Observations with the small bulb in ice were first made with the air temperature at about 68° F. A vessel of hot water, about 100° F., was next quickly placed so as to surround the large bulb and readings continued. After a half-dozen or more measurements the hot water was replaced by ice water, the small bulb being always packed in chipped ice. After a sufficient number of observations had been taken in this way, additional readings were made with the large bulb packed in chipped ice. The most careful scrutiny failed to detect any appreciable effect whatever upon the vapor pressures obtained under these circumstances. If, however, the water is in one bulb exposed freely in the air, and the other bulb be surrounded by ice, the pressure instantly falls to very nearly its value at 32°, but results obtained under these circumstances are found to be one or two hundredths of a millimeter higher than those taken after all the water has distilled into the bulb surrounded with ice; this accords well with what might be expected.

The single observation given in Table II with tube No. 7 is the mean of the results under the different conditions referred to above, not including, however, any case where the water was partly in one bulb and partly in another at a different temperature.

Owing to the great strain incident to submerging the large bulb of this apparatus in a liquid bath the stem was accidentally broken when about to make readings at low temperatures. The manometer tubes, however, were not injured and were afterwards reconstructed into tube No. 9, which is shown complete in Fig. 5.

Tube No. 8 (see Fig. 6): The manometer columns in this tube were even greater than in No. 7, being about 30 mm. in diameter. The special object of the two bulbs seen in the figure appears from what follows: We may imagine that the small quantity of water or ice in the bottom of the bulb may lag in its temperature behind that of the surrounding bath of liquid and the walls of the bulb. Differences of this character would be greatly lessened if the water or ice could be spread evenly over the entire inner walls of the bulb. This can be done in the case of ice, by first bringing all the water into the small bulb; if now the large bulb is placed in the bath the temperature of which is already considerably below the freezing point, the condensation of the vapor in the large bulb will be in the form of frost, which evenly coats the entire inner walls. Some peculiar phenomena observed in this connection are mentioned at the end in discussing the freezing of water.

This precaution of securing great sensitiveness is quite unnecessary however, as not the slightest lagging of the temperature within the bulb has even been detected. The changes are believed to be even more rapid than with sensitive mercurial thermometers; certainly much faster than alcohol thermometers.

The two manometric columns in tube No. 8 were not quite parallel with each other, being slightly nearer together at the top than at the bottom. In consequence of this some difficulties were always experienced in securing the most satisfactory view and clear-cut definition of the tops of the mercurial columns. Greater irregularities were also found in the results obtained on different occasions than seemed reasonable to expect, and the vapor pressures given by this tube are not believed to be so accurate as those from the next.

Tube No. 9: This is shown in Fig. 5 mounted upon the stand used to support the tubes when observations were being taken. The two bulbs seen on this tube were provided for with a view to studying the question of vapor pressures differentially. The tube is first filled in the usual way with the water all upon one side. By placing the tube nearly flat or horizontal, it is so arranged that the mercury in the monometer will separate in the connecting neck, thus permitting the vapor to pass into the bulb theretofore vacant; a portion of the water may also then be distilled over. On restoring the apparatus to its normal condition we may surround one bulb with ice, for example, and vary the temperature of the other bulb as desired, and *vice versa*. Such methods would greatly lessen errors of capillarity, but with large manometer tubes such errors do not occur, and although tube No. 9 was made with the intention of taking differential observations such as mentioned above, yet the scheme was never carried out, as this tube proved to be the very best of all made and gave such satisfactory results that I have preferred to retain it in its normal condition.

In view, therefore, of the very apparent superiority of some tubes over others, I have, in combining the results, believed it best to arbitrarily favor certain results. No effort has been made to combine the values in Table I of results above the freezing point.

The systematic and gradually increasing difference from tabular values is strongly marked, yet the work in this direction is not sufficiently extended to warrant discussion.

Since all the observations with the bulbs in melting ice agree very closely, different weights are of little importance and the simple arithmetical mean has been adopted as the final value.

All the other results given in Table III have been determined as follows:

The observations made with tube No. 9 have been given a weight of 5, those with tube No. 8 a weight of 2, and those with the small tubes, namely, Nos. 4, 5, and 6, a weight of 1. Only a few observations have been made with tubes Nos. 4 and 6, and these, in all cases, were combined with those by No. 5, giving equal weights, and the mean result thus found combined with the corresponding results from tubes Nos. 8 and 9, as stated above. As the values by the small tubes have, in all cases, been lower than the other values their effect has been to always lower the mean value. Now, since observations with the small tubes have not been made at temperatures lower than —35°, it becomes necessary to change slightly the relative weights given the observations by tubes Nos. 8 and 9 at temperatures from —35° to —60°. The mean values in Table III below —35° have, therefore, been computed by giving results by No. 9 a weight of 2 and those by No. 8 a weight of 1. I have been guided in the modifications made in the weights below —35° by a regard for the even and regular manner in which the curve of plotted observations extended itself along this portion of its length.

In a few instances, where it was desirable to combine several observations at temperatures not very near to each other, I have used an interpolated value. This was computed by first finding the mean difference between the actual values and the table, then applying this difference to the tabular value at the desired temperature. If tabular values were not available a portion of the observations were plotted and the interpolated value taken from the curve.

Some may be disposed to criticise the above methods of combining results as arbitrary and subject to personal bias. I am convinced, however, that the intuitive judgment of the observer himself, based upon a knowledge of many experimental details not practicable to discuss, is the best guide we have and

Fig. 7.

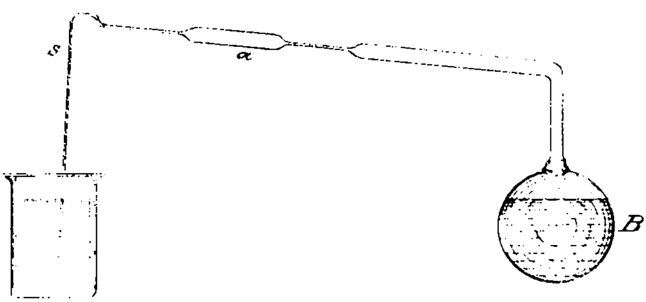
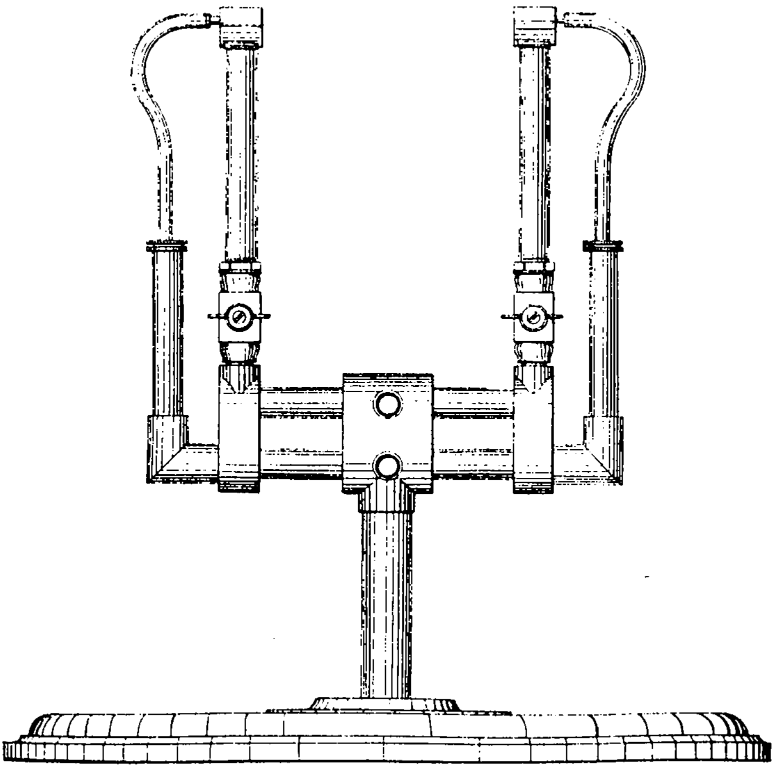


Fig. 8.



affords the truest estimation as to the most probable value in the case of such observations as these now under consideration.

Thus we have derived the results in Table III. There are also given here, first, the differences between the observed and Broch's tabular values, expressed both in pressures and temperatures; and also, where possible, the difference between Regnault's actual experiments and my own, all values being reduced to normal temperature and manometric units. This last comparison is very instructive, since it shows that in almost every value there is even closer agreement between the two experimental results than between the tabular values and the experiments they are presumed to represent.

TABLE III.—COMBINED RESULTS.

Temperature.	Pressure.	Broch—Marvin.		Regnault minus Marvin pressure.
		Pressure.	Temperature.	
° *F.*	*mm.*	*mm.*	° *F.*	*mm.*
32.00	4.5683	+.0004	....	....
31.97	4.553	+.011	—0.05	+.011
25.07	3.318	+.127	—0.90	+.071
19.91	2.597	+.178	—1.55	+.074
14.87	2.043	+.192	—2.05	+.075
9.91	1.598	+.198	—2.59	+.071
5.03	1.248	+.192	—3.13	+.061
— 0.05	0.973	+.165	—3.31	+.041
— 5.18	0.729	+.163	—4.12	+.033
—10.21	0.560	+.137	—4.36	+.020
—14.97	0.428	+.121	—4.81	+.059
—20.10	0.318	+.103	—5.53	+.073
—25.20	0.237	+.083	—5.8	....
—30.07	0.176	+.069	—6.3	....
—34.98	0.130	+.055	—7.1	....
—40.30	0.098	+.037	—6.5	....
—45.01	0.074	+.028	—6.0	....
—50.08	0.053	+.021	—5.5	....
—55.30	0.034	+.019	—8.6	....
—60.23	0.030	+.008	....	....

PRESSURE TABLES AND FORMULÆ OF INTERPOLATION.

Upon general principles it would doubtless be decided that the most probable series of values of vapor pressures are to be derived from a combination of the results of all experiments available. I have been deterred from making such a combination, however, because of the doubtful adjustment of values below the limits of Regnault's or other experiments, and the consequent discontinuity in results meeting at that point. Only, therefore, the values given in the second column of Table III have been used in computing the final table of pressures below the freezing point. For vapor pressures at temperatures above the freezing point Broch's computed values agree closely with Regnault's observations, and are doubtless the best thus far available.

Moritz, by the aid of two formulæ, both previously used by Regnault himself, has also given a very good reduction of the latter's experiments. In the tables both of Broch and Moritz, however, the computed pressures are systematically higher than the observed pressures, notwithstanding that Broch's formulæ of interpolation in particular is a most powerful one, containing not less than six constants and with the temperature to the fifth power, thus:

$$H=a\,10^{\frac{bt+ct^2+dt^3+et^4+ft^5}{1+kt}}$$

For k the coefficient of expansion of hydrogen has been used.

In consequence of the notable failure of means of this kind to afford satisfactory systems of interpolation, and in the absence of any complete and correct mathematical theory of vapor pressures, the problem of the construction of a table is troublesome and its solution more or less unsatisfactory. It appears to me, however, that our best course is to adhere closely to the experimental values, especially in preference to computed values that are systematically discordant.

After some attempts at a mathematical system of interpolation I have discarded them all and resorted at once to the purely graphical solution. The observations in Table III have been repeatedly plotted upon accurately ruled cross-section paper. The scale used has always been large, and not only with different parts of the table, but especially in the upper portion, the scale has been varied as much as practicable.

The plan I have found best for drawing a smooth curve through the observations thus plotted has been by use of a slender even-grained pine stick. A square section is best, I think, and should be large enough to require considerable stress to bend it to fit the curve of observations. The assistance of two or three pairs of hands is generally necessary, and secures the best results.

In drawing the curves of observations after this fashion, I soon found that there was practically no choice whatever but to pass the line exactly through each observation. The curve thus obtained, even when critically examined, was remarkably regular, and any attempt to avoid this or that observation had nothing on its face to justify it, and could not improve the regularity of the curve. The single exception to this is in the case of the observations at —55° and —60°, when it seemed best to deflect the curve a little so as to pass between, rather than exactly through, these observations.

From curves prepared in this manner and ruled upon different scales, and with sticks of different thickness, etc., readings of the pressure, always to three decimal places, have been taken for every degree between 32° and—60° F. The close agreement of these values from the various curves leaves no doubt in my mind of the complete elimination of peculiarities of curvature dependent upon the flexure of the stick or the character of the scale. Where a perceptible difference has occured a mean value to the nearest third decimal place has been adopted.

Table IV was then constructed for each tenth degree by well-known methods of interpolation.

TABLE IV.

Temperature.	Vapor pressure (millimeters).									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
°F.										
32	4.568									
31	4.364	4.384	4.404	4.424	4.444	4.464	4.485	4.505	4.526	4.547
30	4.169	4.188	4.207	4.226	4.245	4.265	4.284	4.304	4.324	4.344
29	3.982	4.000	4.018	4.037	4.055	4.074	4.093	4.112	4.131	4.150
28	3.803	3.820	3.838	3.856	3.874	3.892	3.910	3.928	3.946	3.964
27	3.631	3.648	3.665	3.682	3.699	3.716	3.733	3.750	3.768	3.785
26	3.466	3.482	3.498	3.514	3.531	3.547	3.564	3.580	3.507	3.614
25	3.307	3.322	3.338	3.354	3.370	3.386	3.402	3.418	3.434	3.450
24	3.155	3.170	3.185	3.200	3.215	3.230	3.245	3.260	3.276	3.291
23	3.009	3.023	3.037	3.052	3.066	3.081	3.095	3.110	3.125	3.140
22	2.869	2.883	2.897	2.911	2.925	2.939	2.953	2.967	2.981	2.995
21	2.735	2.748	2.761	2.774	2.788	2.801	2.815	2.828	2.842	2.855
20	2.607	2.620	2.632	2.645	2.657	2.670	2.683	2.606	2.709	2.722
19	2.486	2.498	2.510	2.522	2.534	2.546	2.558	2.570	2.582	2.595
18	2.371	2.382	2.393	2.404	2.416	2.427	2.439	2.450	2.462	2.474
17	2.262	2.272	2.283	2.294	2.305	2.316	2.327	2.338	2.349	2.360
16	2.158	2.168	2.178	2.188	2.199	2.209	2.220	2.230	2.241	2.251
15	2.058	2.068	2.078	2.088	2.098	2.108	2.118	2.128	2.138	2.148

TABLE IV—Continued.

Temperature.	Vapor pressure (millimeters).									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
14	1.961	1.970	1.980	1.989	1.999	2.009	2.018	2.028	2.038	2.048
13	1.867	1.876	1.885	1.895	1.904	1.913	1.923	1.932	1.942	1.951
12	1.776	1.785	1.794	1.803	1.812	1.821	1.830	1.839	1.848	1.857
11	1.688	1.696	1.705	1.714	1.722	1.731	1.740	1.749	1.758	1.767
10	1.603	1.611	1.620	1.628	1.636	1.645	1.653	1.662	1.670	1.679
9	1.523	1.531	1.539	1.547	1.555	1.563	1.571	1.579	1.587	1.595
8	1.447	1.455	1.462	1.470	1.477	1.485	1.492	1.500	1.508	1.515
7	1.376	1.383	1.390	1.397	1.404	1.411	1.418	1.425	1.433	1.440
6	1.309	1.316	1.322	1.329	1.335	1.342	1.349	1.355	1.362	1.369
5	1.246	1.252	1.258	1.264	1.271	1.277	1.283	1.290	1.296	1.303
4	1.186	1.192	1.198	1.204	1.210	1.216	1.222	1.228	1.234	1.240
3	1.129	1.135	1.140	1.146	1.151	1.157	1.163	1.168	1.174	1.180
2	1.075	1.080	1.086	1.091	1.096	1.102	1.107	1.113	1.118	1.124
1	1.023	1.028	1.033	1.038	1.043	1.049	1.054	1.059	1.064	1.070
+0	0.972	0.977	0.982	0.987	0.992	0.997	1.002	1.007	1.012	1.017
—0	0.972	0.967	0.962	0.957	0.952	0.947	0.942	0.937	0.932	0.927
—1	0.922	0.917	0.912	0.907	0.902	0.897	0.892	0.887	0.882	0.877
—2	0.873	0.868	0.863	0.858	0.854	0.849	0.844	0.840	0.835	0.830
—3	0.826	0.821	0.817	0.812	0.808	0.803	0.799	0.794	0.790	0.785
—4	0.781	0.777	0.772	0.768	0.764	0.759	0.755	0.751	0.747	0.742
—5	0.738	0.734	0.730	9.726	0.722	0.718	0.714	0.710	0.706	0.702
—6	0.698	0.695	0.691	0.687	0.683	0.680	0.676	0.672	0.669	0.665
—7	0.661	0.658	0.654	0.651	0.647	0.644	0.640	0.637	0.633	0.630
—8	0.627	0.623	0.620	0.617	0.614	0.610	0.607	0.604	0.601	0.598
—9	0.595	0.591	0.588	0.585	0.582	0.579	0.576	0.573	0.570	0.567
—10	0.564	0.561	0.558	0.555	0.552	0.549	0.546	0.543	0.540	0.537
—11	0.534	0.531	0.528	0.525	0.522	0.519	0.516	0.513	0.510	0.507
—12	0.505	0.502	0.499	0.496	0.494	0.491	0.488	0.486	0.483	0.480
—13	0.478	0.475	0.473	0.470	0.468	0.465	0.462	0.460	0.457	0.455
—14	0.452	0.450	0.447	0.445	0.442	0.440	0.437	0.435	0.432	0.430
—15	0.427	0.425	0.422	0.420	0.417	0.415	0.412	0.410	0.407	0.405
—16	0.403	0.400	0.398	0.396	0.393	0.391	0.389	0.386	0.384	0.382
—17	0.380	0.377	0.375	0.373	9.371	0.368	0.366	0.364	0.362	0.360
—18	0.358	0.356	0.354	0.352	0.350	0.348	0.346	0.344	0.342	0.340
—19	0.338	0.336	0.334	0.332	0.330	0.328	0.326	0.324	0.322	0.320
—20	0.319	0.317	0.315	0.313	0.311	0.310	0.308	0.306	0.304	0.303
—21	0.301	0.299	0.297	0.296	0.294	0.292	0.291	0.289	0.287	0.286
—22	0.284	0.282	0.281	0.279	0.278	0.276	0.274	0.273	0.271	0.270
—23	0.268	0.267	0.265	0.264	0.262	0.261	0.259	0.258	0.256	0.255
—24	0.253	0.252	0.250	0.249	0.247	0.246	0.244	0.243	0.242	0.240
—25	0.239	0.237	0.236	0.234	0.233	0.232	0.230	0.229	0.227	0.226
—26	0.225	0.224	0.223	0.221	0.220	0.219	0.217	0.216	0.215	0.213
—27	0.212	0.211	0.210	0.208	0.207	0.206	0.204	0.203	0.202	0.201
—28	0.199	0.198	0.197	0.196	0.195	0.193	0.192	0.191	0.190	0.189
—29	0.187	0.186	0.185	0.184	0.183	0.182	0.180	0.179	0.178	0.177
—30	0.176	0.175	0.174	0.172	0.171	0.170	0.169	0.168	0.167	0.166
—31	0.165	0.164	0.163	0.162	0.161	0.160	0.159	0.158	0.157	0.156
—32	0.155	0.154	0.153	0.152	0.151	0.150	0.149	0.148	0.147	0.146
—33	0.146	0.145	0.144	0.143	0.142	0.142	0.141	0.140	0.139	0.138
—34	0.138	0.137	0.136	0.135	0.135	0.134	0.133	0.132	0.132	0.131

TABLE IV—Continued.

Temperature.	Vapor pressure (millimeters).									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
°F.										
—35	0.130	0.129	0.129	0.128	0.127	0.126	0.126	0.125	0.124	0.123
—36	0.123	0.122	0.121	0.121	0.120	0.120	0.119	0.118	0.118	0.117
—37	0.117	0.116	0.115	0.115	0.114	0.114	0.113	0.112	0.112	0.111
—38	0.111	0.110	0.109	0.109	0.108	0.108	0.107	0.106	0.106	0.105
—39	0.105	0.104	0.104	0.103	0.103	0.102	0.102	0.101	0.101	0.100
—40	0.100	0.099	0.098	0.098	0.097	0.097	0.096	0.096	0.095	0.095
—41	0.094	0.094	0.093	0.093	0.092	0.092	0.091	0.091	0.090	0.090
—42	0.089	0.089	0.088	0.088	0.087	0.087	0.086	0.086	0.085	0.085
—43	0.084	0.084	0.083	0.083	0.082	0.082	0.081	0.081	0.080	0.080
—44	0.079	0.079	0.078	0.078	0.077	0.077	0.076	0.076	0.075	0.075
—45	0.074	0.074	0.073	0.073	0.072	0.072	0.071	0.071	0.070	0.070
—46	0.069	0.069	0.068	0.068	0.068	0.067	0.067	0.066	0.066	0.065
—47	0.065	0.065	0.064	0.064	0.063	0.063	0.063	0.062	0.062	0.061
—48	0.061	0.061	0.060	0.060	0.059	0.059	0.059	0.058	0.058	0.057
—49	0.057	0.057	0.056	0.056	0.055	0.055	0.055	0.054	0.054	0.053
—50	0.053	0.053	0.052	0.052	0.051	0.051	0.051	0.050	0.050	0.049
—51	0.049	0.049	0.048	0.048	0.048	0.047	0.047	0.047	0.046	0.046
—52	0.046	0.046	0.045	0.045	0.045	0.044	0.044	0.044	0.043	0.043
—53	0.043	0.043	0.042	0.042	0.042	0.041	0.041	0.041	0.040	0.040
—54	0.040	0.040	0.039	0.039	0.039	0.038	0.038	0.038	0.037	0.037
—55	0.037	0.037	0.036	0.036	0.036	0.035	0.035	0.035	0.035	0.034
—56	0.034	0.034	0.034	0.033	0.033	0.033	0.033	0.033	0.032	0.032
—57	0.032	0.032	0.032	0.031	0.031	0.031	0.031	0.031	0.030	0.030
—58	0.030	0.030	0.030	0.029	0.029	0.029	0.029	0.029	0.028	0.028
—59	0.028	0.028	0.028	0.027	0.027	0.027	0.027	0.027	0.026	0.026
—60	0.026	-------	-------	-------	-------	-------	-------	-------	-------	-------

Up until almost the completion of my study of this question I had expected to be able to utilize in some way the series of observations made in Minnesota by Prof. Hazen. (See Annual Report Chief Signal Officer, 1890, p. 660.) But the peculiar behavior of the apparatus, as there discussed by him, and the discordance of his results with those obtained here, have raised so many doubts respecting the accuracy of the instrument furnished him that his values have not been combined in reducing these results. The success I have met with in using the direct-measurement apparatus, when fitted with a new tube, confirms my first impression that the real source of error in his results lies in the imperfectly prepared tube itself.

It is with some diffidence that I have presented the results of this investigation in the form of Table IV, not only because of its uncommon, possibly somewhat inelegant, method of interpolation, but as well because of the union therein of the metric unit of length with the Fahrenheit unit of temperature. The merit of the method of interpolation is the accuracy with which it matches the observations; a claim of distinction to which none of the more elegant mathematical formulæ are entitled. The advantage of the selection of units is quite as justifiable. The temperature units are on a smaller scale, and the pressures expressed in millimeters avoids the long decimal fraction which is necessary when the inch is the unit.

PSYCHROMETRIC TABLES.

The ultimate object of the material and data derived from this investigation has been the formation of humidity tables for use with the pyschrometric or other dew-point observations.

On first thought it was imagined sufficient to recompute the tables such as are used by this service for all temperatures below 32° F., as this was the only part affected by the new values of the vapor pressure. Closer examination, however, showed that a very large part of the values above 32° would also need to be recomputed, and that the new values differed noticeably from the old in many instances. Moreover, from the limited number of experiments made upon vapor pressures above 32°, it is impossible to establish any new values for this part of the vapor-pressure tables, yet it is clearly apparent that additional observations in this direction would be of great value. In view of these circumstances, after having completed the computation of the humidity tables for all temperatures below 32° down to — 50°, I was deterred from reconstructing the upper part of the table owing to the seeming probability of its being again changed whenever any revision of the pressure values above 32° was made.

The humidity tables below 32° are given herewith and may serve as means of comparing the values derived from the new vapor pressures with those previously used.

The psychrometric formula used is that deduced by Prof. Ferrel, and discussed and developed by him in his report for 1886. (See Annual Report Chief Signal Officer, 1886, p. 249.)

The formula is as follows:

$$p = p' - 0.000660P\,(t - t')\,(1 + 0.00115t').$$

In his own computation of tables Prof. Ferrel used a modification of the above formular ostensibly to facilitate computation, though of doubtful effect in this respect. The modified formula reads:

$$p = p' - 0.000660P\,(t - t')\,\big(1 + 0.00115\,(t - t')\big)$$

in which $t - t'$ is used in the last term, in place of t'; Prof. Ferrel assuming that the two were sufficiently nearly equal to warrant the substitution. This, however, is scarcely justifiable, and in the tables given below the formula has been used in its proper form.

PSYCHROMETRIC TABLE.—DEW-POINTS AND RELATIVE HUMIDITIES.

Air Temperature (t) Fahr.	Depression of the wet-bulb thermometer (t—t'), Fahr.									
	.1		.2		.3		.4		.5	
	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.
—50	—60	51	------	------	------	------	------	------	------	------
—49	—58	54	------	------	------	------	------	------	------	------
—48	—56	57	------	------	------	------	------	------	------	------
—47	—54	60	------	------	------	------	------	------	------	------
—46	—53	62	------	------	------	------	------	------	------	------
—45	—51	65	------	------	------	------	------	------	------	------
—44	—50	67	—60	33	------	------	------	------	------	------
—43	—49	69	—58	37	------	------	------	------	------	------
—42	—48	71	—56	40	------	------	------	------	------	------
—41	—46	72	—54	44	------	------	------	------	------	------
—40	—45	73	—52	46	------	------	------	------	------	------
—39	—44	74	—50	49	------	------	------	------	------	------
—38	—43	76	—49	51	—58	27	------	------	------	------
—37	—42	77	—48	54	—55	31	------	------	------	------
—36	—41	78	—46	56	—53	34	------	------	------	------
—35	—39	79	—44	59	—51	38	------	------	------	------
—34	—38	80	—43	61	—49	41	—58	22	------	------
—33	—37	81	—42	63	—47	44	—55	25	------	------
—32	—35	83	—40	65	—45	47	—52	30	------	------
—31	—34	84	—38	67	—43	50	—49	34	—58	18
—30	—33	85	—36	69	—41	53	—47	38	—55	22

PSYCHROMETRIC TABLE.—DEW-POINTS AND RELATIVE HUMIDITIES.

Air temperature (t) F.	Depression of the wet-bulb thermometer ($t-t'$) Fahr.									
	.2		.4		.6		.8		1.0	
	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.
—29	—35	71	—44	42	------	------	------	------	------	------
—28	—33	72	—42	45	—56	17	------	------	------	------
—27	—32	74	—40	48	—52	22	------	------	------	------
—26	—30	76	—37	51	—48	26	------	------	------	------
—25	—29	77	—35	53	—45	31	------	------	------	------
—24	—28	78	—34	56	—43	34	—58	12	------	------
—23	—27	79	—32	58	—40	37	—53	16	------	------
—22	—26	80	—30	60	—37	40	—49	20	------	------
—21	—25	81	—29	62	—35	44	—45	25	------	------
—20	—23	82	—28	64	—33	47	—41	29	—55	11
—19	—22	83	—26	66	—31	49	—38	33	—50	16
—18	—21	84	—25	68	—29	52	—35	36	—45	20
—17	—20	85	—23	70	—27	54	—32	39	—41	24
—16	—19	86	—22	71	—26	57	—30	43	—37	28
—15	—17	86	—20	73	—24	59	—28	46	—34	32
—14	—16	87	—19	74	—22	61	—26	48	—31	36
—13	—15	88	—18	76	—21	63	—25	51	—29	39
—12	—14	88	—17	77	—20	65	—23	53	—27	42
—11	—13	89	—16	78	—18	67	—21	56	—25	45
—10	—12	90	—14	79	—17	68	—20	58	—23	48
— 9	—11	90	—13	80	—15	70	—18	60	—21	50
— 8	—10	90	—12	81	—14	71	—17	62	—20	52
— 7	— 9	91	—11	82	—13	73	—15	63	—18	54
— 6	— 8	91	—10	83	—12	74	—14	65	—16	56
— 5	— 7	92	— 8	83	—10	75	—12	67	—15	58
— 4	— 6	92	— 7	84	— 9	76	—11	68	—13	60
— 3	— 4	92	— 6	85	— 8	77	—10	70	—12	62
— 2	— 3	93	— 5	86	— 6	78	— 8	71	—10	64
— 1	— 2	93	— 4	86	— 5	79	— 7	72	— 9	66
± 0	— 1	93	— 3	87	— 4	80	— 6	74	— 7	67

PSYCHROMETRIC TABLE.—DEW-POINTS AND RELATIVE HUMIDITIES—Cont'd.

Air temperature (*t*) F.	Depression of the wet-bulb thermometer (*t* — *t'*) Fahr.									
	1.2		1.4		1.6		1.8		2.0	
	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.
—17	—55	9	------	------	------	------	------	------	------	------
—16	—49	14	------	------	------	------	------	------	------	------
—15	—44	19	------	------	------	------	------	------	------	------
—14	—39	23	—52	10	------	------	------	------	------	------
—13	—35	27	—46	15	------	------	------	------	------	------
—12	—32	30	—41	19	—55	7	------	------	------	------
—11	—30	34	—36	23	—48	12	------	------	------	------
—10	—27	37	—33	26	—42	16	—58	5	------	------
— 9	—25	40	—30	30	—37	20	—48	10	------	------
— 8	—23	43	—27	33	—33	24	—42	14	—58	5
— 7	—21	45	—25	36	—30	27	—36	18	—48	9
— 6	—19	48	—23	39	—27	31	—32	22	—41	13
— 5	—17	50	—21	42	—24	34	—29	25	—35	17
— 4	—16	52	—19	45	—22	37	—26	29	—31	21
— 3	—14	55	—17	47	—20	40	—23	32	—28	25
— 2	—12	57	—15	50	—18	42	—21	35	—24	28
— 1	—11	59	—13	52	—16	45	—18	38	—22	31
± 0	— 9	61	—11	54	—14	48	—16	41	—19	35

Air temperature. (*t*) F.	Depression of the wet-bulb thermometer (*t* — *t'*) F.							
	2.2		2.4		2.6		2.8	
	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.
—6	—56	5	------	------	------	------	------	------
—5	—47	9	------	------	------	------	------	------
—4	—39	13	—54	5	------	------	------	------
—3	—33	17	—44	10	------	------	------	------
—2	—29	21	—36	14	—48	7	------	------
—1	—26	25	—31	18	—39	11	—54	4
±0	—23	28	—27	22	—33	15	—43	9

PSYCHROMETRIC TABLE.—DEW-POINTS AND RELATIVE HUMIDITIES—Cont'd.

Air temperature (t) F.	Depression of the wet-bulb thermometer (t—t') Fahr.									
	.2		.4		.6		.8		1.0	
	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.
+ 1	0	94	— 2	87	— 3	81	— 4	75	— 6	69
2	+ 1	94	— 1	88	— 2	82	— 3	76	— 5	70
3	2	94	+ 1	88	— 1	83	— 2	77	— 3	71
4	3	94	+ 2	89	0	83	— 1	78	— 2	73
5	4	95	3	89	+ 1	84	0	79	— 1	74
6	5	95	4	90	3	85	+ 1	80	0	75
7	6	95	5	90	4	85	3	80	+ 1	76
8	7	95	6	91	5	86	4	81	3	76
9	8	96	7	91	6	86	5	82	4	77
10	9	96	8	91	7	87	6	83	5	78
11	10	96	9	92	8	87	7	83	6	79
12	11	96	10	92	9	88	9	84	8	80
13	12	96	11	92	11	88	10	84	9	81
14	13	96	12	93	12	89	11	85	10	81
15	14	96	13	93	13	89	12	86	11	82
16	15	97	15	93	14	90	13	86	12	83
17	16	97	16	93	15	90	14	87	13	83
18	17	97	17	94	16	90	15	87	14	84
19	18	97	18	94	17	91	16	88	15	84
20	19	97	19	94	18	91	17	88	17	85

Air temperature (t) F.	Depression of the wet-bulb thermometer (t—t') Fahr.									
	1.2		1.4		1.6		1.8		2.0	
	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.
+ 1	— 8	63	—10	56	—12	50	—14	44	—17	38
2	— 6	64	— 8	58	—10	52	—12	46	—15	40
3	— 5	66	— 7	60	— 8	54	—10	49	—13	43
4	— 4	67	— 5	62	— 7	56	— 9	51	—11	45
5	— 2	68	— 4	63	— 5	58	— 7	53	— 9	48
6	— 1	70	— 3	65	— 4	60	— 6	54	— 7	50
7	0	71	— 1	66	— 3	61	— 4	56	— 6	51
8	+ 1	72	0	67	— 1	62	— 3	58	— 4	53
9	3	73	+ 1	68	0	64	— 1	59	— 3	55
10	4	74	3	69	+ 1	65	0	61	— 1	57
11	5	75	4	71	3	66	+ 2	62	0	58
12	7	76	5	72	4	68	3	64	+ 2	60
13	8	77	7	73	6	69	5	65	3	61
14	9	78	8	74	7	70	6	67	5	63
15	10	79	9	75	8	71	7	68	6	64
16	11	79	10	76	10	73	9	69	8	66
17	12	80	12	77	11	74	10	70	9	67
18	14	84	13	78	12	74	11	71	10	68
19	15	81	14	78	13	75	12	72	11	69
20	16	82	15	79	14	76	13	73	13	70

PSYCHROMETRIC TABLE.—DEW-POINTS AND RELATIVE HUMIDITIES—Cont'd.

Air temperature (*t*) F.	Depression of the wet-bulb thermometer (*t*—*t'*) Fahr.									
	2.2		2.4		2.6		2.8		3.0	
	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.
+1	—20	32	—24	25	—28	19	—35	13	—46	7
2	—17	35	—21	29	—25	23	—30	17	—37	11
3	—15	37	—18	32	—21	26	—26	20	—31	15
4	—13	40	—16	34	—19	29	—22	24	—27	18
5	—11	42	—14	37	—16	32	—19	27	—23	22
6	— 9	44	—12	39	—14	34	—17	29	—20	25
7	— 8	47	—10	42	—12	37	—14	32	—17	28
8	— 6	49	— 8	44	—10	39	—12	35	—15	30
9	— 4	51	— 6	46	— 8	42	—10	37	—12	33
10	— 3	52	— 4	48	— 6	44	— 8	40	—10	35
11	— 1	54	— 3	50	— 4	46	— 6	42	— 8	38
12	0	56	— 1	52	— 2	48	— 4	44	— 6	40
13	+ 2	58	+ 1	54	— 1	50	— 2	46	— 4	42
14	4	59	2	56	+ 1	52	0	48	— 2	45
15	5	61	4	57	3	54	+ 1	50	0	47
16	7	62	5	59	4	56	3	52	+ 2	49
17	8	64	7	60	6	57	5	54	3	51
18	9	65	8	62	7	59	6	56	5	53
19	10	66	10	63	9	60	8	57	7	54
20	12	67	11	64	10	61	9	58	8	56

Air temperature (*t*) F.	Depression of the wet-bulb thermometer (*t*—*t'*) Fahr.									
	3.2		3.4		3.6		3.8		4.0	
	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.
+2	—50	5	----	----	----	----	----	----	----	----
3	—39	9	—54	4	----	----	----	----	----	----
4	—32	13	—42	8	—60	2	----	----	----	----
5	—28	16	—34	11	—45	6	----	----	----	----
6	—24	20	—29	15	—35	10	—47	5	----	----
7	—20	23	—24	18	—29	13	—37	9	—50	4
8	—17	26	—21	21	—25	17	—30	12	—38	8
9	—15	28	—18	24	—21	20	—25	15	—31	11
10	—12	31	—15	27	—18	23	—21	19	—26	14
11	—10	34	—12	30	—15	26	—18	22	—21	18
12	— 8	36	—10	32	—12	28	—15	25	—18	21
13	— 5	39	— 7	35	— 9	31	—12	27	—14	24
14	— 3	41	— 5	37	— 7	34	— 9	30	—11	27
15	— 2	43	— 3	40	— 5	36	— 7	33	— 9	29
16	0	46	— 1	42	— 3	39	— 4	36	— 6	32
17	+ 2	48	+ 1	44	— 1	41	— 2	38	— 4	35
18	4	49	2	46	+ 1	43	0	40	— 2	37
19	5	51	4	48	3	45	+ 1	42	0	39
20	7	53	6	50	5	47	3	44	+ 2	41

PSYCHROMETRIC TABLE.—DEW-POINTS AND RELATIVE HUMIDITIES—Cont'd.

Air temperature (t) F.	Depression of wet-bulb thermometer (t — t') Fahr.									
	4.2		4.4		4.6		4.8		5.0	
	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.
+ 8	—53	3								
9	—39	7	—55	2						
10	—31	10	—40	6	—57	2				
11	—26	14	—31	10	—41	6	—60	2		
12	—21	17	—26	13	—31	9	—41	5	—59	2
13	—17	20	—21	16	—25	13	—31	9	—40	5
14	—14	23	—17	19	—20	16	—25	12	—30	9
15	—11	26	—14	23	—16	19	—20	16	—24	12
16	— 8	29	—10	25	—13	22	—16	19	—19	16
17	— 6	31	— 8	28	—10	25	—12	22	—15	19
18	— 3	34	— 5	31	— 7	28	— 9	25	—12	22
19	— 1	36	— 3	33	— 5	30	— 7	27	— 9	24
20	+ 1	38	— 1	35	— 2	33	— 4	30	— 6	27

Air temperature (t) F.	Depression of wet-bulb thermometer (t — t') Fahr.									
	5.2		5.4		5.6		5.8		6.0	
	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.
+13	—58	2								
14	—39	5	—56	2						
15	—30	9	—38	5	—53	2				
16	—23	12	—28	9	—36	6	—50	2		
17	—18	16	—22	12	—27	9	—34	6	—47	3
18	—14	19	—17	16	—21	13	—26	9	—32	6
19	—11	21	—14	19	—17	16	—20	13	—25	10
20	— 8	24	—10	21	—13	19	—16	16	—19	13

Air temperature (t) F.	Depression of wet-bulb thermometer (t — t') Fahr.							
	6.2		6.4		6.6		6.8	
	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.
+18	—44	3						
19	—30	7	—40	4	—60	1		
20	—23	10	—29	7	—37	5	—52	2

PSYCHROMETRIC TABLE.—DEW-POINTS AND RELATIVE HUMIDITIES—Cont'd.

Air temperature (t) F.	Depression of wet-bulb thermometer (t—t') Fahr.									
	.5		1.0		1.5		2.0		2.5	
	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.
+20	18	92	17	85	15	77	13	70	10	63
21	19	93	18	85	16	78	14	71	12	64
22	20	93	19	86	17	79	15	72	13	65
23	22	93	20	86	18	80	16	73	14	66
24	23	93	21	87	19	80	18	74	16	67
25	24	94	22	87	21	81	19	74	17	68
26	25	94	23	88	22	81	20	75	18	69
27	26	94	24	88	23	82	21	76	20	70
28	27	94	25	88	24	82	22	77	21	71
29	28	94	26	89	25	83	24	77	22	72
30	29	94	27	89	26	84	25	78	23	73
31	30	95	29	89	27	84	26	79	24	74
32	31	95	30	90	28	84	27	79	26	74

Air temperature (t) F.	Depression of wet-bulb thermometer (t—t') Fahr.									
	3.0		3.5		4.0		4.5		5.0	
	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.
+20	8	56	5	48	+ 2	41	— 2	34	— 6	27
21	9	57	7	50	+ 4	43	0	36	— 4	29
22	11	58	8	51	6	45	+ 2	38	— 1	32
23	12	60	10	53	7	46	4	40	+ 1	34
24	14	61	11	54	9	48	6	42	+ 3	36
25	15	62	13	56	11	50	8	44	5	38
26	16	63	14	57	12	51	10	45	7	40
27	18	64	16	59	14	53	11	47	9	42
28	19	65	17	60	15	54	13	49	11	43
29	20	66	19	61	17	56	14	50	12	45
30	22	67	20	62	18	57	16	52	14	47
31	23	68	21	63	19	58	18	53	15	48
32	24	69	22	64	21	59	19	54	17	50

PSYCHROMETRIC TABLE.—DEW-POINTS AND RELATIVE HUMIDITIES—Cont'd.

Air temperature (t) F.	Depression of wet-bulb thermometer ($t-t'$) Fahr.									
	5.5		6.0		6.5		7.0		7.5	
	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.
+20	−12	20	−19	13	−32	6	......	......	......	......
21	− 8	23	−15	16	−24	9	−47	2	......	......
22	− 6	25	−11	19	−19	12	−31	6	......	......
23	− 3	27	− 8	21	−14	15	−24	9	−45	2
24	− 1	30	− 5	24	−10	17	−18	11	−30	6
25	+ 2	32	− 2	26	− 7	20	−13	14	−22	8
26	+ 4	34	0	28	− 4	23	− 9	17	−17	11
27	6	36	+ 3	30	− 1	25	− 6	19	−12	14
28	8	38	5	33	+ 1	27	− 3	22	− 8	17
29	10	40	7	35	+ 4	29	0	24	− 4	19
30	11	41	9	36	6	31	+ 2	26	− 2	22
31	13	43	11	38	8	33	5	29	+ 1	24
32	15	45	13	40	10	35	7	31	+ 4	26

Air temperature (t) F.	Depression of wet-bulb thermometer ($t-t'$) Fahr.									
	8.0		8.5		9.0		9.5		10.0	
	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.	D. P.	R. H.
+25	−42	3	......	......	......	......	......	......	......	......
26	−28	6	......	......	......	......	......	......	......	......
27	−20	9	−37	3	......	......	......	......	......	......
28	−15	11	−25	6	−54	1	......	......	......	......
29	−10	14	−18	9	−32	4	......	......	......	......
30	− 6	17	−13	12	−22	7	−43	2	......	......
31	− 3	19	− 8	14	−15	10	−27	5	......	......
32	0	21	− 4	17	−10	12	−18	8	−33	3

It gives me great pleasure to acknowledge my indebtedness throughout the progress of this work to those serving with me in the instrument division. The intelligent and able assistance rendered me by Mr. D. T. Maring in the performance of the routine work of the instrument division has relieved me of the consideration of many questions in this connection and enabled me to give a larger proportion of my time to the experimental work than would otherwise have been possible. During the actual observations the manipulation of the low-temperature apparatus, and particularly the reading of the thermometers, have been almost entirely intrusted to Mr. H. H. Kimball, who has also performed the greater part of the mathematical work connected with the reduction of observations and computation of tables. His skill and accuracy as an observer and computer are, in addition to his general ability, highly commendable.

NOTE UPON THE ABNORMAL FREEZING OF WATER AND CORRESPONDING VAPOR PRESSURES.

During the progress of the vapor-pressure work considerable difficulty was experienced in freezing the water capsules used in the experiments, and the peculiar results obtained indicate the possibility of water retaining its liquid condition under very unusual circumstances.

Mention was made on page 360 of the method of breaking the water capsule by freezing. For this purpose the tube *a*, Fig. 9, was wholly surrounded by a freezing mixture of salt and ice. In many instances, even after from one to two hours' exposure in this manner to a temperature continuously from 3° to 5° below zero, F., the water in the capsule remained unfrozen. It is true the transfer of heat from the water through the vacuum must undoubtedly have been very slow, taking place quite wholly by radiation, yet the temperature was certainly very low, and the phenomenon of not freezing a real one, as the same result was obtained with a precisely similar capsule directly immersed and moved freely about within the liquid freezing mixture. In this case there could be no doubt as to the temperature. In both of these cases, although it was possible to considerably agitate and jar the capsule, yet the water so very nearly filled it as to be but very little disturbed; nevertheless in the case of the free capsule the small bubble of space within could be made to move about from end to end, etc., yet without the slightest effect to induce solidification. It was therefore found necessary to lower the temperature still further to effect freezing, which was generally successfully accomplished at temperatures from —10° to —15° F. I am disposed to believe, however, that the real temperature of the water in such cases may doubtless have been little lower than —5°, but that it could be appreciably higher than 0° seems scarcely credible under the circumstances.

In more than one instance solidification took place within the capsule, but peculiarly enough it was not broken thereby, and, in consequence, I have even been to the annoyance of entirely refilling the apparatus in order to introduce a new capsule of thinner glass and presumably less strong. Subsequent experience, however, led me to believe that in all these cases the failure to break the capsule was really due to the fact that a part only of the water was frozen, and had sufficient time been given, the capsule must surely have burst. It was at first imagined, since the solidification was practically instantaneous, that the whole mass froze at once. This, however, does not appear to be the case, as is indicated by the following considerations: Water in freezing must give off about 140 units of heat. If now, without freezing, the temperature be lowered to, say, —5° F., that is, 37° below the normal freezing point, about 37 units of heat have been withdrawn in lowering the temperature more than is really necessary. When, therefore, solidification once starts the dissipation of 37 units of the latent heat of freezing can take place with great suddenness and operates to warm up the whole mass of water to its normal freezing point. On this account less than one-third of the water can suddenly freeze, and further solidification can take place only on the slow dissipation of the latent heat.

Phenomena of this character were repeatedly observed with different capsules, and subsequently a few other experiments in the same direction were made. Thus, a capsule of somewhat larger dimensions was attached to a piece of spirit-thermometer tubing having a comparatively fine bore. This was filled with well-boiled, distilled water and sealed up after the manner of a thermometer.

The elimination of air from the water or the space above was by no means so perfect in this thermometer as in the capsules used in the vapor-pressure tubes. Marks were made on the tubes at the points opposite the top of the water column when the bulb was in ice, and also at the temperature of maximum density. Thus the water was made to roughly indicate its own temperature, but more particularly showed the changes in volume with temperature. When the bulb was immersed and moved about within the freezing mixture, the column would soon fall to the point of maximum density, and would gradually ascend again and pass considerably beyond the line marking the volume at the freezing point, showing thereby that the *expansion observed to take place in water, from the point of maximum density to the normal freezing point, is continuous when under any circumstances the water may be cooled below this normal freezing point without solidification*. As soon, however, as the water reaches the point at which it will start to freeze, there is a very sudden solidification of a part of the water, and the increase in volume is very great, forcing the unfrozen water far up into the chamber at the top of the stem.

The structure of the ice in these cases, as, in fact, in all others of sudden freezing, is coarsely crystalline, presenting many arrangements of long, interlacing needles, and giving a somewat milky color to the whole. An instant's exposure of the frozen bulb to the air quickly loosens the ice from the walls of the bulb, and as it melts slowly can be seen to rise to the top side of the bulb as the latter is revolved or turned about into different positions. The ice seems to be a comparatively compact mass throughout, not shell-like, as might be imagined.

When the small quantities of water used in the vapor-pressure bulbs were subjected to low temperatures, here also freezing never took place at the normal temperature. As the temperature of the bath in which the bulb of the pressure apparatus was immersed was gradually lowered during the observations, it was customary to frequently lift up the bulb and examine if the water was frozen. This was never found to be the case until the temperature was many degrees below the normal freezing point, and no amount of agitation and slopping about of the water had any visible effect in hastening the freezing. It was not practicable to actually witness the freezing; after passing some low temperature the water was found to be frozen. On several occasions the mercurial columns were continuously watched during the lowering of temperature. Presently a sudden increase was observed to take place in the vapor pressure, followed by nearly as sudden a return to the previous condition. The mercurial columns in these cases never reached closely their positions corresponding to the pressure at the normal freezing point. This action takes place no doubt at the instant of freezing and indicates a rise in the temperature. The large surface of exposure of the bulb prevents any great difference of temperature between the vapor within and the bath, and the small quantity of water is very quickly entirely frozen.

On page 368 it it shown how the water may be made to frost itself over the inner surface of the large bulb. On one occasion this was tried by placing the large bulb in the bath at a temperature of about 25° F. After some time the water had entirely distilled into the large bulb, and this being as much as 7° below the freezing point it was expected to find an even coat of frost inside. On examination, however, the vapor had not condensed as frost, and water in the liquid state only was found. The temperature was then lowered, as usual, to nearly 5° before the water, as shown by frequent examinations, and notwithstanding much agitation, was found frozen.

The water in this same bulb, on other occasions, was always frozen at a temperature of 10° as was also the water in the other pieces of apparatus. As near as could be told the temperature of freezing was about 11° to 14° F. We have in this then not only the abnormal existence of water in the liquid state at very unusual temperatures but a somewhat corresponding behavior of the vapor which does not necessarily solidify on condensation at a temperature lower than the normal freezing point.

This experiment of distillation was repeated on another occasion with the temperature of condensation at about 5° F. In this case the water in the small bulb was almost instantly frozen by its own evaporation and persistently remained so despite moderate applications of heat, such as the hand, warm water, etc. After all the ice had distilled into the large bulb the latter was found to be beautifully coated inside with thin ice crystals.

In order to examine some points respecting the freezing of water under these circumstances, a bulb not encumbered with the manometric tubes and mercurial columns was exhausted and a capsule of water broken within. In this case the water capsule froze and burst after about two hours' exposure in an ice and salt mixture at a temperature not at any time higher than—3° F. The water in this bulb behaved in all respects similar to that in the regular vapor pressure tubes and even when violently shaken could not be frozen until cooled to a temperature of about 12° F. If, however, the water, once frozen, was almost entirely melted, leaving only a small fragment of ice, and then again cooled slightly below the normal freezing point, the whole mass soon became solid. The presence of the small fragment of ice at starting seems necessary to induce solidification at the normal freezing temperature.

When air was admitted to this bulb and the water shaken about a few minutes, it could be frozen at about 25° F.

ABNORMAL VAPOR PRESSURES.

In all the observations of the vapor pressure, when the temperature of the water was below the normal freezing point and the water still in the liquid state, the pressure was always observed to be greater than when the water at the same temperature was in the form of ice. The following table shows the differences found in the pressures under these circumstances:

No. of observations.	Temperature.	Pressure.		Difference.	
		From ice.	From water.	Ice—water.	Ice—Broch.
	°F.				
....	32.00	(?)	4.568	(?)	(?)
3........	24.83	3.280	3.419	—.139	+.007
4........	19.87	2.591	2.771	—.180	+.001
4........	14.84	2.042	2.237	—.195	+.005
1........	10.06	1.608	1.786	—.178	—.022

The same methods have been followed in combining the results by the different tubes, as have been already described in connection with Table III.

Although, in all cases, the water would remain liquid at temperatures far below the normal freezing point, yet, after being once frozen, no melting could be detected until a temperature of 32° was reached. At this point melting always began, and the vapor pressures thus observed can not, therefore, be considered strictly as observed over ice, as it was impossible to prevent incipient melting, giving rise to at least a thin film of water over the ice. The vapor pressures measured over ice at temperatures a fraction of a degree below 32°, and given in the second value in Table III, agree so closely with those over water *exactly at* 32° as to lead to the conclusion that the vapor pressure over dry ice at the melting point is exactly the same as that over water at the normal freezing point.

The striking agreement with Broch's tables, of vapor pressures from water at temperatures at which it should be frozen but still remains liquid, is remarkable and seems very significant.

The last value in the table above is the result of only one observation taken with tube No. 8, which may account, in part at least, for the larger difference in the last column.

The peculiar behavior of water as thus discussed, has in some particulars been observed by others, though the general impression appears to be that a little agitation or disturbance is sufficient to induce freezing whenever the temperature is below the normal freezing point. This is not at all the case with the experiments above described, as the temperature at which solidification took place seemed quite definite and depended wholly upon temperature.

I have not been able to find any note of the abnormal freezing of water under quite the circumstances of my own experiments.

Boussingault (Comptes Rend., Tome LXXIII, p. 77) perfectly filled a very strong steel cylinder with water at its maximum density which was afterwards not frozen upon long exposure at a temperature — 24° C. Here the effect of enormous pressure comes into play.

Dufour (Ann. Chim. et Phys., T. LXVIII, p. 370) discusses the nonfreezing of globules of water in suspension within an another liquid of same density.

Water in very fine capillary tubes has also been observed by Sorby (Phil. Mag., 4th series, Vol. XVIII, p. 105) to retain the liquid state at very low temperatures. Fine mist particles have also been observed to be in the liquid state at temperatures much below the freezing point.

The almost perfect elimination of air and dust particles from the water seems to have very much to do with these peculiar phenomena of solidification.

PART II.—NORMAL BAROMETER.

The Signal Service standard of barometric pressure has, at least in recent years if not since the establishment of the Service, aimed to be a copy of the Kew standard. With this object in view a number of carefully constructed cistern barometers of the Adie pattern, with tubes having an internal diameter of about 10 mm., were procured abroad and carefully compared with the Kew standards. Many intercomparisons of these barometers among themselves and with other instruments used previously by the Service as standards were made, and the whole subject of the standard of barometric pressure studied and reported upon in 1881 by a board appointed for that purpose. Their report is to be found on p. 1126, annual report of the Chief Signal Officer, 1881.

Subsequently a slight readjustment of corrections of four of the Adie barometers was made in order to bring their indicated pressures into agreement, and one of the four, viz: number 1526, believed to be the best of the lot, was officially designated as the standard.

Comparative readings between the four barometers referred to above, together with a standard barometer made by Green, of New York, have been made regularly every month, with very few exceptions, until the present time. These comparisons still show a very close agreement between the barometers, and we are justified in saying that no preceptible deterioration has taken place or change occurred in the standards of pressure.

It has long been recognized that such a standard of barometric pressure was of doubtful and uncertain accuracy, and steps have been taken from time to time to establish a normal barometer of the best possible construction. A length comparator, and a very excellent cathetometer already mentioned above on p. 357, were procured some years since. Also, two standards of length, a yard and meter, bar and a similar bar a half meter in length. These latter were ruled by

Prof. William A. Rogers, and their corrections and coefficients of expansions carefully determined.

The first steps toward the improvement of the Signal Service barometric standard were made by Prof. Russell, who set up a barometer tube of very large diameter filled with mercury after having been first carefully exhausted. No convenient arrangements were provided for changing noticeably the size of the vacuum chamber, and it was therefore impracticable to determine fully the real state of the vacuum. From electrical discharges, however, passed through the tube before it was filled with mercury, the character of the spark and interval between centers of luminosity indicated a comparatively good state of exhaustion but by no means as perfect as it was possible to attain. The office was at that time not itself in possession of facilities for exhausting the tube, and was obliged to depend for the exhaustion upon the manufacturer of the tube. The filling was accomplished by breaking off under mercury the tip of a long, narrow end provided for that purpose and allowing the tube to fill. It seems scarcely possible to secure the most satisfactory results in this way, even with a highly exhausted tube to begin with. The rapid inrush of mercury is apt to drag in with it air adhering to the outer surfaces of the tube and thus impair the vacuum. In reading this barometer the mercurial surface at the top of the column was sighted by Marek's* reflection method, similar principles being employed for sighting the mercurial surface in the cistern.

In developing a form of normal barometer it is necessary to consider the causes leading to errors in the measurement of the barometric height. The first, and perhaps the most important, of these is the imperfect condition of the vacuum at the top of the mercurial column. To render this so perfect as not to produce a sensible depression of the mercurial column requires great care in the exhaustion and construction of the barometer, yet modern appliances render it possible to attain a very satisfactory state of affairs in this respect. Nevertheless, the instrument can not be regarded as of high accuracy without some means either of directly measuring the vacuum from time to time or of renewing it, as one may desire. To accomplish the first of these, it is generally sufficient to construct the barometer so that the volume of the vacuum chamber can be increased and diminished by lowering and raising the cistern. The renewal of the vacuum at any time is rendered possible by one or more ingenius arrangements that have been devised from time to time, such as the one employed in the barometer described below.

A second source of error is found in the capillary action of the mercury and glass. This, however, can be wholly avoided by using tubes of large internal diameter, so that the central portion of the top of the mercury column shall be perfectly flat. Fully 30 mm. in diameter is necessary for this.

A third and very important cause of inaccuracy in readings of barometers is the uncertain amount of the correction for the temperature of the mercury and scale. The mean of a large number of readings, taken under all sorts of conditions, is probably very little in error in most cases, but for single readings it is very important that the exact mean temperature of the barometric column should be known. In order, too, that various barometers, even when reduced to a standard temperature, should agree when exposed to the same pressure, it is necessary that the mercury be in each case of the same normal density. It is, therefore, necessary to know accurately the exact normal density of the mercury in any particular barometer, and to correct for this if it departs from a standard density.

With such conditions as these in mind the barometer shown in Fig. 11 has been prepared. In order to determine, by trial, the best method of sighting the mercurial meniscuses, and also the most convenient and satisfactory arrangement of the parts and accessories, only a temporary wooden mounting, shown in the figure, has been used thus far. Later, when all the accessories are developed and arranged in the most complete and convenient manner, the temporary support will be replaced by a substantial permanent mounting.

The barometer tube proper, *a b c*, is in the form of an inverted U. The narrow portion *a*, has an internal diameter of about 7 mm.; the enlarged portion *b*, is about 30 mm., internal diameter. The top of *b* is narrowed down and fused to a long, slender, capillary tube, *c*, of only about one-half millimeter internal diameter. The lower portion of the capillary tube is provided with a double turn and a small chamber, *c'*, while the end of the tube itself dips into a small vessel of mercury. The crooked end and chamber form a reservoir of mercury that lessen

* Rep. für Exp. Phy., Band 16, p. 585.

Fig. 9.

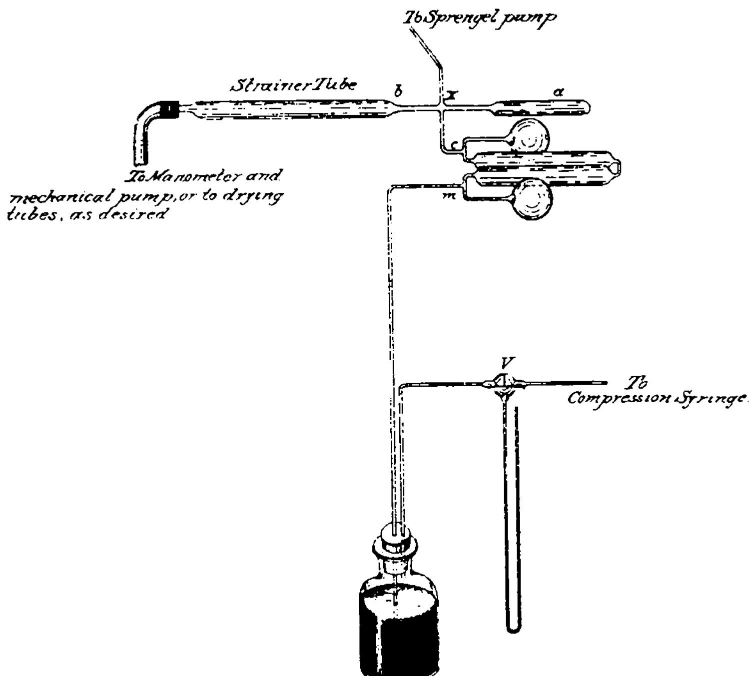


Fig. 10.

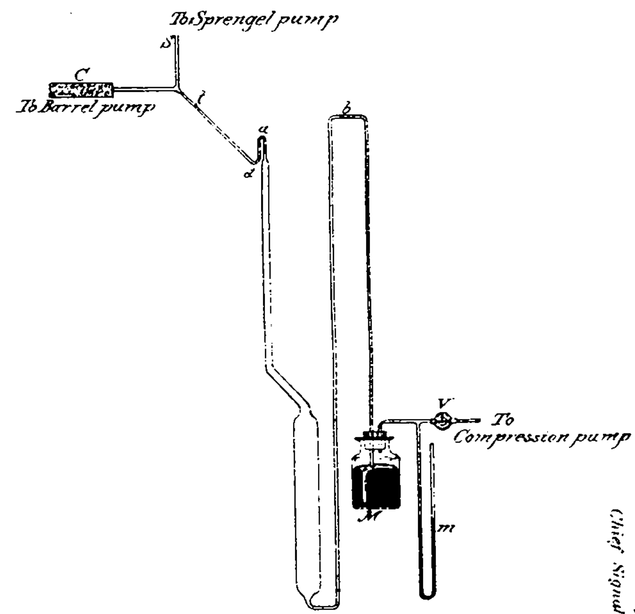
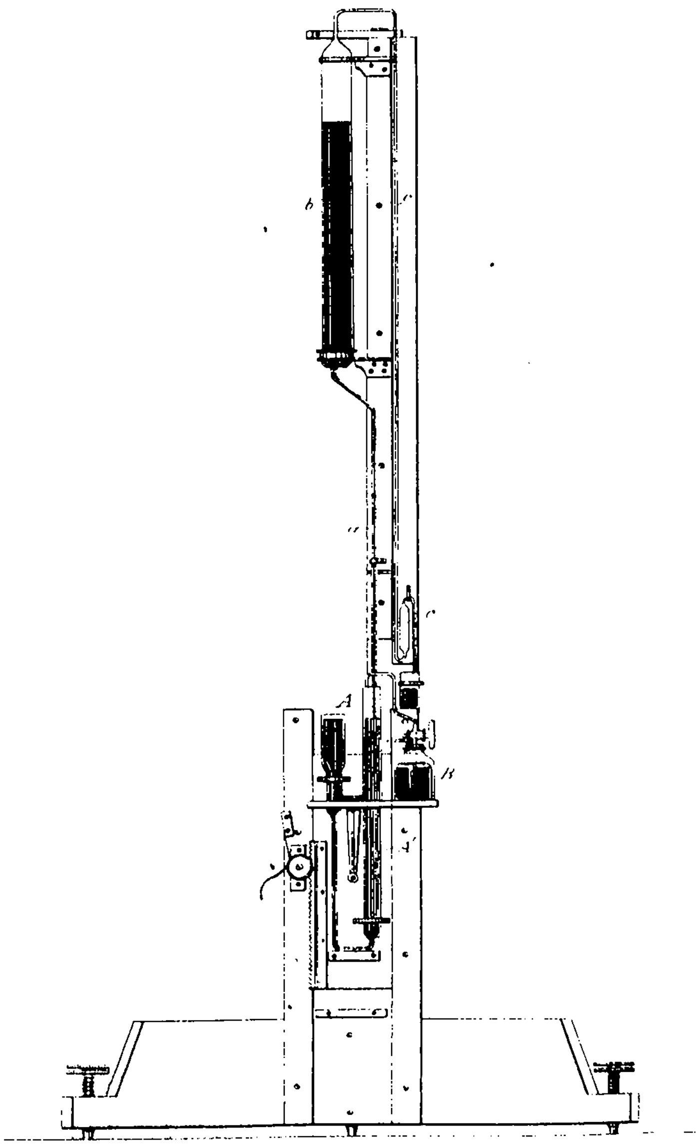


Chart No. 1—Appendix 10.
Chief Signal Officer.

Fig. 11.



the possibility of air accidentally entering the barometer if the end of the capillary tube should, in any event, become uncovered with mercury. The lower end of tube *a*, entering the cistern, is narrowed and turned upward, forming a short syphon trap. The cistern has the peculiar form shown, and is very deep, so that it can be raised and lowered very much. The two arms A, A', of the cistern communicate with each other at the bottom, and also just beneath the enlarged portion at A. This latter communication is desirable, in order to facilitate the free interchange of the mercury in the two sides to the more easily preserve equilibrium in the temperature.

The cistern is attached to a suitable board moving by means of a rack and pinion arrangement between the guides on the barometer support. Secured to this slide is also a small shelf supporting the bottle B containing a supply of mercury for use when the cistern is raised and lowered. The cork of the bottle B, is fitted with the syphon tube and also a small air vent. The syphon tube dips into the mercury in the arm A' of the cistern. An ordinary rubber hand-bulb can be attached to the air vent. The syphon may be started once for all by squeezing the rubber bulb sufficiently to force the mercury through the syphon tube, which is fitted with a stop-cock, as shown.

When the cistern is raised, mercury must of course be supplied to fill up the large space in the top of the barometer. When the cistern is nearly filled and at its highest point, the mercury rises to the extreme top of the barometer tube. Any air or gases in the vacuum space are compressed at first and finally driven into the fine capillary tube *c*, where they are imprisoned by the mercury falling into the vertical part of the tube, and may ultimately be carried out entirely, after the manner of the action of a Sprengel pump. When the mercury is withdrawn from the capillary tube a wholly new vacuum is formed by the breaking apart of the mercury at some point in the horizontal part at the top. This highly ingenious and effective provision for renewal of the barometric vacuum is, I believe, originally due to Prof. Wright, of Yale University.

With such an arrangement of the barometer we may not only greatly vary the volume of the vacuum chamber, but the vacuum may be wholly renewed and made very perfect, as has just been explained.

It will be noticed that all parts of the barometer with which mercury has contact are of glass. This is believed to be a desirable condition that should always be secured.

The barometric scale can be of almost any description, and will be adjustably suspended near the barometer tube, as may be desired. The meter scale now provided consists of a cylindrical steel rod five-sixteenths inch in diameter, slightly flattened upon one side for the rulings, which are in millimeters for the whole length of the scale.

The real worth of instruments of this character is in the excellence with which the tube has been exhausted and filled.

The following brief description of the method of preparing and mounting this barometer is given:

The glass used is of the same composition as that of the vapor pressure tubes already described in Part I, and has been selected with particular care. Some thought was at first entertained of having the upper portion of the tube carefully ground and polished by skilled opticians in order to lessen or prevent errors from irregular refraction by the glass tube. The process of grinding and polishing such tubes as could be used, and the great liability of the finished tube afterward cracking into pieces on being heated for attaching the various parts, not only presents many difficulties and involves such grave uncertainties of being successfully accomplished, but also is so doubtful of really improving in noticeable degree the optical uniformity of the tube, that the idea is not believed practicable.

The first step in the assembling of the parts of the barometer is to prepare the cistern. This is thoroughly washed and dried, using methods similar to those applied in the washing and drying the vapor-pressure tubes. After draining out the alcohol used in the last washing a piece of clean kid leather is securely tied over the end of tube A of the cistern. The other end is fitted with a cork and tube connecting with the air pump. By dipping the wide end in mercury so as to cover up the leather the tube may be exhausted and dried in the usual manner, the mercury and leather covering serving to effectually seal that end of the tube. When quite well dried and while still warm, mercury, also warm, is poured in through a long, fine-necked funnel. The cistern is next secured to its slide and set aside until the barometer tube is filled.

The means used to exhaust and fill this tube were in all respects similar to those described on pages 354 and 360, in connection with the construction of the vapor-pressure tubes.

The operations of washing and drying were carried on with great care and made most effectual.

Fig. 10 shows in general the arrangements of the tube and accessories as attached to the air pumps for drying, exhaustion, etc. The bent portions of the tubes at *a* and *b* are represented for greater clearness as in the plane of the paper, but are preferably at right angles to that plane, especially *a*. After a very thorough drying the final exhaustion was carried on over a period of four or five days, with frequent heatings of the tube in order to more effectually dislodge gases adhering to the glass surfaces. When the vacuum was as perfect as possible the barometer tube was sealed off from the pump at such a point as at *t*. The flow of mercury into the exhausted tube was effected by increasing the air pressure in the bottle M sufficient to raise the mercury over the bend at *b*, thus effecting a continuous flow into the barometer tube until the latter is entirely filled, having due regard for plenty of opportunity for the mercury to expand if its temperature is afterwards higher. Any air and residual gases not exhausted from the barometer tube are driven before the advancing mercury and finally compressed in the end of the tube at *t*. The air pressure in the bottle M, always under control by means of the three-way cock at V, may be reduced when the tube is filled and the flow of mercury interrupted. The tube of the mercury bottle is next fused off near *b*. Throughout these operations the barometer tube is mounted upon a board to facilitate handling, etc. After separation from the pump and mercury bottle the whole is laid horizontally and transferred to the temporary support, also in a horizontal position. The bend at *a* and its connecting tube out to *t* now project upward, giving rise to a small mercury pressure inside, tending to prevent the separation of the mercury at any point while handling. When all has been secured to the support the end portion of the tube near *t* is broken off sharply at the bend *d*, exposing the mercury at this point to the air pressure.

The top end of the support and barometer tube may now be raised at a very considerable angle without any danger of mercury escaping from the lower end. In this position the cistern filled with mercury and attached to its slide, as already described, is inserted in the guides and raised until the lower end of the barometer tube is wholly submerged and the cistern at its highest position. The narrow cylindrical form of the cistern easily permits inclining it very much to the vertical without danger of spilling the mercury, especially with the wide end at A covered with kid skin, as explained above. The barometer may now be raised to the vertical and is easily and safely moved about as may be desired. On lowering the cistern by its rack and pinion attachment the barometric column takes its normal height. It now remains only to break open the lower end of the capillary tube and place beneath it any suitable cistern. The level of the mercury in the capillary tube immediately falls, of course, to its normal barometric height.

At the present time the progress of the work upon the normal barometer has extended but little beyond the actual setting up of the instrument and has been conducted at intervals between the experimental work upon vapor pressures.

The reconstruction of piers and other repairs and improvements in the standards room subsequently gave rise to still further interruption.

The careful comparison of the normal with the service standards is, therefore, reserved for future discussion.

APPENDIX 11.

REPORT OF BIBLIOGRAPHER AND LIBRARIAN.

LIBRARY, SIGNAL OFFICE, *June 30, 1891.*

SIR: I have the honor to transmit to you the following statement relating to the work of the bibliographer and librarian for the fiscal year ending June 30, 1891:

LIBRARY.

In recommending books for purchase and in collecting by exchange for the library, the policy adopted by you in 1887 has been followed, of confining all additions to the library strictly to publications necessary for making this a working meteorological and military signaling library. In following out this policy, from 500 to 600 volumes and pamphlets belonging to the library have during the past two years been discarded as not bearing closely enough upon the work of the office. These volumes are in addition to the 1,261 volumes transferred to the War Department library by your order in 1887.

Nine hundred and fifty volumes and 350 pamphlets have been added to the library during the year, making a total at present in the library of 12,482 volumes and about 3,000 pamphlets; of these about 500 volumes and about 200 pamphlets relate to military signaling.

By far the greater number and the more valuable publications in the library have been obtained through a system of mutual exchange with home and foreign weather services and with scientific societies, the small amount of money available for books being spent in the purchase of periodicals and the more important private publications.

The new alcoves and additional shelving provided for the library in the fall and winter of 1889-'90 have made it possible, for the first time in the history of the service, to arrange the books upon the shelves in an orderly manner so as to make them readily accessible when called for. This classified arrangement of the books was completed during the present year.

The policy adopted by some of the larger libraries of the country of loaning books to persons at distant points who are engaged in special investigations has been followed during the year with gratifying results, the recipients expressing themselves as greatly aided, while in no case has the library suffered the loss or mutilation of a single volume or pamphlet.

It is a source of pleasure to note that, so far as can be judged from printed catalogues at hand and from an inspection of the reports of the directors of foreign meteorological services, the library of the Signal Service compares favorably with any of the special libraries devoted mostly to meteorology, as regards the amount of printed literature and the convenience of its arrangement for reference. While the library is very deficient in the earlier publications, it is well represented in recent literature from about 1850, and is especially rich in observations, weather maps, and bulletins.

BIBLIOGRAPHY.

During the fiscal year just ended, two additional divisions of the bibliography of meteorology have been reproduced by the milliograph process, the division of winds and that of storms, the former comprising about 2,000 titles, the latter about 4,300 titles.

The following table shows the number of books and papers represented in the divisions thus far issued, the number and precentage in the library of the Signal Office, and the number of authors:

	When issued.	Number of titles.	Number in library of Signal Office.	Percentage in library of Signal Office.	Number of authors.
Part I. Temperature	1889	4,400	2,100	47	1,800
Part II. Moisture	1889	5,500	2,435	44	2,650
Part III. Winds	1891	2,000	1,100	55	960
Part. IV. Storms	1891	4,300	2,380	54	1,647
Total		16,200	8,015	50	

As shown by the above table, about 16,000 titles are comprised in the divisions published, or about one-fourth of the entire catalogue.

As opportunity was afforded during the year, titles were added to the catalogue, extending the period covered from 1881 to 1889. The total number of titles now on hand is about 60,000, of which about 10,000 fall within the period from 1882-'89.

The general bibliography has been serving the purpose of a library catalogue by the addition of the abbreviation "(Sig.)" to the title to indicate the presence of the publication in the library of this office.

As an appendix to this report, a list is submitted containing the publications of the Signal Service, excepting such as were issued only for the information of members of the service, and another list containing such publications of individuals connected with the service as were published during the time of such connection and as bear upon the work of the service.

Very respectfully,

O. L. FASSIG,
Bibliographer and Librarian.

Gen. A. W. GREELY,
Chief Signal Officer.

PUBLICATIONS OF THE U. S. SIGNAL SERVICE FROM 1861 TO JULY 1, 1891.

1. Report of the Signal Officer of the Army to the Secretary of War. 8vo. Wash., 1861-1891. 1861-1863, Albert J. Myer, Signal Officer. 1864, W. J. L. Nicodemus, Acting Signal Officer. 1865, 1866, B. F. Fisher, Chief Signal Officer. 1867-1880, Albert J. Myer, Chief Signal Officer. 1881-1886, W. B. Hazen, Chief Signal Officer. 1887-1891, A. W. Greely, Chief Signal Officer.
2. Manual of Signals for the use of Signal Officers in the Field, by Albert J. Myer, Bvt. Brig. Gen. and Chief Signal Officer, U. S. Army. 8vo. N. Y., 1868, 1872, 525 pp. Ill. 8vo. Wash., 1877, 1879.
3. Instructions for Acting Signal Officers. 8vo. Wash., 1869, 148 pp., 10 pls.
4. Report of the Operations and Duties of the Signal Department of the Army, from its Organization to the End of the Civil War. (Compiled by Capt. Howgate.) 8vo. (Washington, 1869?) 258 pp. (No title page.)
5. Cautionary Signals. Division of Telegrams and Reports for the Benefit of Commerce. 8vo. Wash., 1871, 11 pp.
6. Practical use of Meteorological Reports and Weather Maps. 8vo. Wash., 1871, 76 pp. 8vo. (Three editions were issued in 1871. A fourth edition was printed with the title "How to use Weather Maps." Obl. 4to. Wash., 1884, 23 pp. The edition was ordered to be destroyed before the maps and appendices were printed and before being distributed.)
7. Correspondence and Reports in Reference to the Observation and Report of Storms by Telegraph and Signal for the Benefit of Commerce. 8vo. Wash., 1871, 43 pp.; 1872, 203 pp.; 1872, 34 pp.
8. Instructions to Observer Sergeants, Signal Service, U. S. Army, on Duty at Stations. 8vo. Wash., 1871, 25 pp.; 1872, 59 pp.; 1874, 116 pp.; 1875, 139 pp. 4to. Wash., 1879, 162 pp. 8vo. Wash., 1881, 241 pp.: 1887, 142 pp. Title in last edition changed to "General Instructions to Observers of the Signal Service."
9. War Department Weather Maps. Jan. 1, 1871-June 30, 1891. Issued as Tridaily weather maps, Signal Service U. S. Army, Jan 1, 1871-Dec. 31, 1880. Continued as: Daily weather maps, Jan. 1, 1881-Dec. 31, 1886. Continued as: Tridaily weather maps, Jan. 1, 1887-June 30, 1888. Continued as: Bidaily weather maps, July 1, 1888-Sept. 30, 1888. Title changed to Semidaily weather maps, Oct. 1, 1888. 16 by 22 inches., Wash., 1872-1891.
10. Report of Meteorological Observations made at Mount Washington, N. H., during May, 1872. 8vo. (Wash., 1872.) 60 pp.
11. Weekly Weather Chronicle. Nov. 16, 1872, to April 4, 1881. Sm. 4to. Wash., 1872-1881.
12. Daily Bulletin of Weather Reports, taken at 7:35 a. m., 4:35 p. m., and 11:35 p. m., Washington mean time, with the Synopses, Probabilities, and Facts, March, 1872-June, 1877. (Printed monthly.) 8vo. Wash., 1872-1877. (Oct.-Dec., 1875, not published.) Same. Sept., 1872, to Jan., 1875, Jan.-Dec., 1877, with tridaily maps. Jan., 1878-Dec., 1880, without maps. 4to. Wash., 1873-1882. Maps for 1878 printed later as Tridaily meteorological record. Obl. 4to. Wash., 1884. (Feb., 1877, title changed to Daily Bulletin, etc., with synopses, indications, and facts. Sept., 1877, title changed to Daily Bulletin of Simultaneous Weather Reports, etc., with synopses, indications, and facts.)
13. Monthly Weather Review, June, 1872-June, 1891. 4to. Wash., 1872-1891. (The reviews for Oct., 1872-Dec., 1883, also published in the annual reports.)
14. The Iowa and Illinois Tornado of May 22, 1873. A report to the Chief Signal Officer by Observer-Sergeant Jas. MacKintosh. 8vo. (Wash., 1873). 89 pp. (Reprinted from the annual report of the Chief Signal Officer for 1873.)
15. Farmers' Bulletin, Synopses and Probabilities (daily). Mar. 24, 1873, to Dec. 31, 1880. 4to. Wash., 1873-1880.
16. Instructions for Making and Reporting Telegraphic River Observations for the Signal Service, U. S. Army. 8vo. Wash., 1873, 21 pp.
17. The Meteorological Record. Sheets issued daily from Jan. 1, 1874, to July 24, 1875. This was merged in the "Bulletin of International Meteorological Observations."

18. Bulletin of International Meteorological Observations taken simultaneously at 7:35 a. m., Jan. 1, 1875–Dec. 31, 1880. Same, taken at 7 a. m., Jan. 1, 1881, to June 30, 1884. (Printed daily.) 4to. Wash., 1875–'85. 1882 title changed to Bulletin of International Meteorology. July, 1884, title changed to Summary and Review of International Meteorological Observations, July, 1884–Dec., 1887. (Printed monthly to Dec., 1887. From Jan., 1888–June, 1889, printed semiannually.) 4to. Wash., 1885–1891.
19. Results and Prospects of the Cautionary Signal System. 8vo. N. t. p. (about 1877), 16 pp.
20. Official Danger or Distress Signals (circular). 8vo. Wash., 1878, 12 pp.
21. Extracts from Legislation and Orders Relating to the Signal Service, U. S. Army, 1860–1879. 8vo. N. t. p. (about 1879), 16 pp. 2 ed., 1860–1881. 8vo. Wash., 1882, 19 pp.; 3 ed., 1860–1886. 1887, 51 pp. See also No. 109.
22. Memoranda on the Work Accomplished by the Signal Service of the United States. 8vo. Wash., 1881, 24 pp.
23. History of the Signal Service, Army of the United States, and Special Catalogue of Exhibit at the International (Paris) Exhibition of Electricity. 8vo. Paris, 1881, 43 pp.

U. S. SIGNAL SERVICE PROFESSIONAL PAPERS.

24. No. 1. Abbe (Cleveland). Report on the Solar Eclipse of July, 1878. 4to. Wash., 1881, 186 pp., 34 pls.
25. No. 2. Greely (A. W.). Isothermal Lines of the United States, 1871–1880. 4to. Wash., 1881, 1 p., 12 pls.
26. No. 3. Greely (A. W.). Chronological List of Auroras Observed from 1870 to 1879. 4to. Wash., 1881, 76 pp.
27. No. 4. Finley (J. P.). Report of the Tornadoes of May 29 and 30, 1879, in Kansas, Nebraska, Missouri, and Iowa. 4to. Wash., 1881, 116 pp., 29 chs.
28. No. 5. Information Relative to the Construction and Maintenance of Time-balls. 4to. Wash., 1881, 31 pp., 3 pls.
29. No. 6. Hazen (H. A.). The Reduction of Air-pressure to Sea Level at Elevated Stations West of the Mississippi River. 4to. Wash., 1882, 42 pp., 20 maps.
30. No. 7. Finley (J. P.). Report on the Character of Six Hundred Tornadoes. 4to. Wash., 1884, 29 pp., 3 chs.
31. No. 8. Ferrel (William). Recent Mathematical Papers Concerning the Motions of the Atmosphere. Part I. The Motions of Fluids and Solids on the Earth's Surface. Reprinted with notes by Frank Waldo. 4to. Wash., 1882, 51 pp.
32. No. 9. Dunwoody (H. H. C.). Charts and Tables showing Geographical Distribution of Rainfall in the United States. 4to. Wash., 1883, 29 pp., 3 chs.
33. No. 10. Tables of Rainfall and Temperature Compared with Crop Production. 4to. Wash., 1882, 15 pp.
34. No. 11. Sherman (O. T.). Meteorological and Physical Observations on the East Coast of British America. 4to Wash., 1883, 202 pp., 1 ch.
35. No. 12. Ferrel (William). Popular Essays on the Movements of the Atmosphere. 4to. Wash., 1882, 59 pp.
36. No. 13. Ferrel (William). Temperature of the Atmosphere and Earth's Surface. 4to. Wash., 1884, 69 pp.
37. No. 14. Finley (J. P.). Charts of Relative Storm Frequency for a Portion of the Northern Hemisphere. 4to. Wash., 1884, 9 pp., 13 chs.
38. No. 15. Langley (S. P.). Researches on Solar Heat and its Absorption by the Earth's Atmosphere. A Report of the Mount Whitney Expedition. 4to. Wash., 1884, 239 pp., 22 pls.
39. No. 16. Finley (J. P.). Tornado Studies for 1884. 4to. Wash., 1885, 15 pp., 72 chs., 72 tables.
40. No. 17. Ferrel (William). Recent Advances in Meteorology. Published as Part 2, Appendix No. 71, of the annual report of the Chief Signal Officer for 1885. 8vo. Wash., 1886, 440 pp.
41. No. 18. Hazen (H. A.). Thermometer Exposure. 4to. Wash., 1885, 32 pp.

U. S. SIGNAL SERVICE NOTES.

42. No. 1. Bailey (W. O.). Report on the Michigan Forest Fires of 1881. 8vo. Wash., 1882, 16 pp., 6 chs.
43. No. 2. Birkhimer (W. E.). Memoir on the Use of Homing Pigeons for Military Purposes. 8vo. W[illegible]., 1882, 27 pp.

44. No. 3. Allen (James). To Foretell Frost. 8vo. Wash., 1882, 11 pp.
45. No. 4. Upton (Winslow). The Use of the Spectroscope in Meteorological Observations. 8vo. Wash., 1883, 7 pp., 3 chs.
46. No. 5. Work of the Signal Service in the Arctic Regions. 8vo. Wash., 1883, 40 pp., 1 ch.
47. No. 6. Hazen (H. A.). Report on Wind Velocities at the Lake Crib and at Chicago. 8vo. Wash., 1883, 20 pp., 1 ch.
48. No. 7. Hazen (H. A.). Variation of Rainfall West of the Mississippi River. 8vo. Wash., 1883, 8 pp.
49. No. 8. Waldo (Frank). The Study of Meteorology in the Higher Schools of Germany, Switzerland, and Austria. 8vo. Wash., 1883, 9 pp.
50. No. 9. Dunwoody (H. H. C.). Weather Proverbs. 8vo. Wash., 1883, 148 pp., 1 map.
51. No. 10. Garlington (E. A.). Report on Lady Franklin Bay Expedition of 1883. 8vo. Wash., 1883, 52 pp., 1 map.
52. No. 11. Ward (F. K.). The Elements of the Heliograph. 8vo. Wash., 1883, 12 pp.
53. No. 12. Finley (J. P.). The Special Characteristics of Tornadoes, with Practical Directions for the Protection of Life and Property. 8vo. Wash., 1884, 19 pp.
54. No. 13. Curtis (G. E.). The Relation between Northers and Magnetic Disturbances at Havana, Cuba. 8vo. Wash., 1885, 16 pp.
55. No. 14. Lamar (W. H., jr.), and Ellis (F. W.). Physical Observations during the Lady Franklin Bay Expedition of 1883. 8vo. Wash., 1884, 62 pp., 14 pls., 1 map.
56. No. 15. Hazen (H. A.). Danger Lines and River Floods of 1882. 8vo. Wash., 1884, 30 pp.
57. No. 16. Curtis (G. E.). The Effect of Wind Currents on Rainfall. 8vo. Wash., 1884, 11 pp., 2 pls.
58. No. 17. Morrill (Park). A First Report upon Observations of Atmospheric Electricity at Baltimore, Md. 8vo. Wash., 1884, 8 pp., 6 chs.
59. No. 18. McAdie (Alexander). The Aurora in its Relations to Meteorology. 8vo. Wash., 1885, 21 pp., 14 chs.
60. No. 19. Glenn (S. W.). Report on the Tornado of August 28, 1884, near Huron, Dak. 8vo. Wash., 1885, 10 pp., 11 chs.
61. No. 20. Hazen (H. A.). Thunderstorms of May, 1884. 8vo. Wash., 1885, 8 pp., 2 chs.

No. 21. How to Use Weather Maps. Not published as Signal Service Notes.

62. No. 22. Russell (Thomas). Corrections of Thermometers. 8vo. Wash., 1885, 11 pp.
63. No. 23. Woodruff (T. M.). Cold Waves and their Progress. A preliminary study. 8vo. Wash., 1885, 21 pp.
64. Instructions to Special Observers in the Cotton Belt. Signal Service Instruction No. 37, 1882. 12mo. Wash., 1882, 14 pp.
65. The Necessity of a Permanent Organization for the Signal Corps. 8vo. Wash., 1882, 30 pp.
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APPENDIX 12.

REPORT OF SUPPLY AND MISCELLANEOUS DIVISION.

SIGNAL OFFICE, WAR DEPARTMENT,
Washington City, July 1, 1891.

SIR: I have the honor to submit the following report of the supply and miscellaneous division for the fiscal year ended June 30, 1891:

PERSONNEL.

Under Special Orders, No. 28, dated Headquarters of the Army, Adjutant-General's Office, Washington, February 2, 1889, I continued on duty as property and disbursing officer of the Signal Service until February 28, 1891. Under the act of October 1, 1890, reorganizing the Signal Corps of the Army, having been commissioned a captain in the Signal Corps, I accepted the same to date March 1, 1891 (vacating my commission as captain and A. Q. M.), and, under a decision of the Second Comptroller of the Treasury that, as "captain, Signal Corps," I could continue to disburse the appropriations for the remainder of the fiscal year ending June 30, 1891, provided I should be designated as disbursing officer by the Secretary of War and file a proper bond, I was, under Special Orders, No. 49, dated Headquarters of the Army, Adjutant-General's Office, Washington, March 4, 1891, so detailed to date from March 1, 1891, and the necessary bond as such disbursing officer was approved by the honorable the Secretary of War on March 5, 1891, and is on file in the Treasury Department.

CLERICAL FORCE.

On July 1, 1890, there were employed in this division 60 persons, 3 enlisted men and 57 civilians, the 60 employés being distributed as follows: clerks, 22 civilians; mechanics, messengers, and laborers, 3 enlisted men and 35 civilians.

On June 30, 1891, there were employed in the division 64 persons, 1 enlisted man and 63 civilians, the 64 employés being distributed as follows: clerks, 21 civilians; mechanics, messengers, and laborers, 1 enlisted man and 42 civilians.

It will be noticed that there was on duty on June 30, 1891, one clerk less than on July 1, 1890, yet the work has been kept well in hand and at no time during the year has it been behind, and at this time, notwithstanding the great amount of work necessitated by the transfer of the Weather Bureau to the Department of Agriculture, there is no unfinished business except that which has accumulated during the last month, and even that is in such shape that it can be disposed of within a very short time.

The force of the division on June 30, 1891, engaged on purely clerical work not including messengers, laborers, and watchmen, consisted of 1 clerk of class 4, 1 clerk of class 2, 10 clerks of class 1, 5 clerks at $1,000, 2 clerks at $900, and 2 copyists at $840, while on July 1, 1890, the force consisted of 1 clerk of class 4, 1 clerk of class 3, 9 clerks of class 1, 7 clerks at $1,000, 3 clerks at $900, and 1 copyist at $720.

It will thus be seen that there has been not only a reduction in the number of persons employed, but in the aggregate salaries paid, in the division. Some of the most experienced clerks have secured transfers to other Bureaus, and the vacancies have been filled by clerks of less experience, and consequently not so efficient as those who have left. The methods, however, are, it is thought, the most simple and businesslike that could be devised consistent with absolute accuracy and thorough efficiency, and thus it has been possible to carry on the work of the division, which involves the disbursement of over $900,000 annually.

the handling of a very large correspondence, the transportation of supplies over the entire country, and the settlement of 10,000 accounts per annum, with a less number of clerks than would have been otherwise required.

CHARACTER OF WORK PERFORMED.

The work of the division is of a very miscellaneous character, comprising the preparation of estimates for appropriations; the preparation of specifications and advertisements for supplies; the issuing of orders and letters authorizing expenditures at stations; the preparation of contracts and of leases; the purchasing, receiving, packing, and shipping of all supplies; the transportation of persons; the handling of all foreign and domestic mail matter; the record of all registered mail sent and received; the invoicing of all property sent; the preparation of all abstracts of property received, expended, and issued; the appointment, transfer, and discharge of civilian employés; the examination, preparation, and settlement of the accounts against this office, including the settlement of the accounts for the salaries of the personnel of the service; the record of sales of publications; the preparation of the money accounts of the disbursing officers, including the abstracts and accounts current; the proper record of all receipts and expenditures of money and the condition of the various appropriations; the examination and audit of the accounts relating to telegraph tolls, and the briefing and indexing of all letters received, and the writing, recording, and mailing of all letters sent relating to the above.

In addition to the clerical force the division has had charge of the heating, lighting, care, policing, and guarding of the premises, including the supervision of the work of all engineers, firemen, watchmen, messengers, laborers, and charwomen, since June 1, 1891.

Owing to the varied and technical character of the work performed, embracing as it does the preparation and settlement of medical accounts, express accounts, transportation accounts, pay accounts, mileage accounts, quartermasters' accounts, and the handling of large quantities of property, etc., the clerks engaged must of necessity possess special skill and fitness and qualifications of a higher order than would be otherwise required, and I am pleased to say that, notwithstanding much of the new work which has been assigned to the division had been never before handled by its clerks, such work has been taken up and disposed of with the greatest expedition.

CHANGE OF DESIGNATION.

Although for administrative purposes the division had been designated as "accounts division," yet in consideration of the varied character of the duties therein performed, as indicated in the foregoing section, it was deemed advisable to apply a designation which would more clearly indicate the scope of the work assigned; accordingly, in the rearrangement of the divisions announced in Instructions No. 13, dated Signal Office, War Department, Washington City, June 13, 1891, the name "supply and miscellaneous division" was applied, and the publications division was attached as a subdivision.

CARD SYSTEM OF RECORDS.

As the terms "letters received" and "letters sent" comprehend nearly all the business of an executive bureau or office, it is a matter of considerable importance to adopt such methods in the handling and recording of said letters as will offer the greatest saving in time and labor consistent with perfect accuracy and thorough reliability, and it is believed that the card system of records which has been in operation in the division for the past two years has demonstrated in the direction of economy of space, saving of labor, and in the expedition of business its superiority over the old and elaborate but profitless and expensive system previously in vogue. The card system has been also applied to the preservation in the division of other data with gratifying results.

The statement following shows in detail the number of cards, covering letters received, opened, for names and subjects, each month during the fiscal year ended June 30, 1891:

Months.	Number of letters received.	Number of cards opened.		Per cent of cards for year opened each month.	
		Writer.	Subject.	Writer.	Subject.
1890.					
July	1,022	68	4	9.9	6.2
August	1,161	51	7	7.4	10.8
September	793	58	6	8.4	9.2
October	867	80	11	11.7	16.9
November	892	69	5	10.2	7.7
December	866	63	8	9.2	12.3
1891.					
January	1,030	52	10	7.6	15.4
February	832	40	1	5.8	1.5
March	1,150	57	5	8.3	7.7
April	1,024	48	5	7.0	7.7
May	1,114	38	0	5.5	0.0
June	1,041	62	3	9.0	4.6
Total	11,792	686	65	100.0	100.0

TOTAL NUMBER OF LETTERS RECEIVED AND INDEX CARDS OPENED FOR THE YEARS 1889-'90 AND 1890-'91.

Years.	Total number letters received.	Number of writer cards opened.	Number of subject cards opened.
1889-'90	11,135	1,790	468
1890-'91	11,792	686	65
Difference	+657	−1,104	−403

CORRESPONDENCE.

The total number of letters received during the year is 17,858 (containing 35,059 inclosures), of which 6,593, being letters of transmittal for bills or accounts, were not entered upon the card record.

The total number of letters sent out is 19,539, which includes 1,345 indorsements.

ESTIMATES.

As required by law, and in compliance with letter of August 18, 1890, from the honorable the Secretary of War, estimates for appropriations for the fiscal year ending June 30, 1892, were submitted to the War Department on September 15, 1890; subsequently, on October 1, 1890, the act of Congress to increase the efficiency and reduce the expenses of the Signal Corps of the Army, and to transfer the Weather Service to the Department of Agriculture was passed, which necessitated the recalling of the estimates submitted to the War Department and the recasting of the same for submission as required by the act; the estimates covering the work of the Signal Corps being prepared under the direction of the Secretary of War, while those for the work of the Weather Bureau were prepared and submitted to the Secretary of Agriculture. The estimates in detail will be found in the "Book of Estimates."

DEFICIENCY ESTIMATES.

Under the act of Congress approved October 1, 1890, being "An act to increase the efficiency and reduce the expenses of the Signal Corps of the Army, and to transfer the Weather Service to the Department of Agriculture," a commissioned force of the Signal Corps was organized, to consist, in addition to the Chief Signal Officer, of one major, four captains (mounted), and four first lieutenants (mounted). No appropriation, however, was made in said act for the pay and allowances of said officers, and the Second Comptroller of the Treasury, to whom the question was referred, decided that the appropriation, "Signal Service pay, etc.," for the current fiscal year was not applicable for such purpose, and as the appropriation for the support of the Army, under existing law, was not available for such payment during the present fiscal year, it became necessary to submit an estimate to provide for the pay and allowances of those officers from the dates they might be commissioned.

The act of Congress above referred to also provided for the mustering out of the service, on June 30, 1891, of the enlisted force. This provision of law required an appropriation for the amounts due by law to said enlisted men at discharge, and an estimate was submitted for the sum of $64,613.27, to cover the following items:

Pay proper (travel allowance)	$9,254.24
Commutation of rations (travel allowance)	3,319.30
Retain pay	8,625.00
Pay for clothing not drawn	34,881.19
Repayment of deposits and interest thereon	8,533.54
Total	64,613.27

Another provision in the act quoted required the separation of military telegraph and meteorological stations, (at places where the offices, then combined, were located in army buildings), and the sum of $900 was asked to provide for the removal of the weather offices and the reerection of meteorological instruments elsewhere on or before June 30, 1891.

Owing to the public demand for the issue of weather maps, the edition was increased from 178,248 in 1886-'87 to 1,069,534 in 1889-'90, and is being increased daily. The estimate for an appropriation under this item for the fiscal year ended June 30, 1891, was based upon the actual number of maps then being issued. Since then it has been found that the sum appropriated would be inadequate to supply the number demanded by the public, and that 200,000 additional maps would be required to last until June 30, 1891, which would cost, under the contract, $810, and an estimate for that sum was therefore submitted.

All of the above estimates received favorable action by Congress, and the necessary appropriations were made by the deficiency act, approved March 3, 1891, with the exception that, instead of appropriating an additional amount for the pay of the officers of the Signal Corps, commissioned under the act of October 1, 1890, Congress, at the suggestion of the Chief Signal Officer, enacted "that the appropriation for the pay of the fourteen second lieutenants of the Signal corps in the sundry civil act, approved August 30, 1890, is hereby made available for the pay, regular supplies, and allowances of one major, four captains, and four first lieutenants, appointed in the Signal Corps under the act of Congress approved October 1, 1890."

ADVERTISEMENTS AND PROPOSALS.

Section 3709 of the Revised Statutes requires that "all purchases and contracts for supplies or services, in any of the departments of the Government, except for personal services, shall be made by advertising a sufficient time previously for proposals respecting the same, when the public exigencies do not require the immediate delivery of the articles or performance of the service."

Under a ruling of the Second Comptroller of the Treasury, where the value of the articles is less than $20, the advertisement for proposals can be waived; in other cases, the office has found it advantageous to strictly follow the law governing advertisements, for by so doing an unfavorable criticism of the accounts is avoided; besides, the office has been enabled to procure the best goods for the least money, and the appropriations have been thereby most judiciously expended.

The plan adopted last year, requiring the successful bidder to deposit a certified check, as well as that of insisting upon a forfeiture in case of delay, have resulted in securing more prompt delivery of orders than had been theretofore the case. In connection with the matter of forfeitures, a question was raised during the year by the accounting officers of the Treasury, as to whether it was in the power of the Chief Signal Officer to waive the penalty when once it had been incurred. The office held that it was within the province of the head of the Bureau, upon proper representation of the matter, to waive the penalty, or any portion of it, if for good and sufficient reasons it was deemed proper to do so, and in order to avoid any question in the future, a clause to that effect has been inserted in all advertisements since issued by this office.

During the year there were issued 356 advertisements (in the shape of circulars) covering the various articles required for the maintenance of the stations of the Service.

REDUCTION IN THE COST OF SERVICE.

As illustrative of the reduction in the cost, during the past six years, for the maintenance of the Service, in all its branches, the following table is appended, which shows for the fiscal years ended June 30, 1886, to June 30, 1891, the aggregate amount appropriated in regular and deficiency bills, excepting only the deficiency of $64,613.27, being an extraordinary appropriation rendered absolutely necessary by the reorganization of the Weather Bureau on a civilian basis. It should be understood that these amounts include also all claims allowed and certified by the accounting officers of the Treasury on account of deficiencies in subappropriations. This makes the table a comparable one with respect to the cost of the Signal Corps and Weather Bureau as regards their maintenance from year to year.

Designation of appropriation.	1886.	1887.	1888.
Salaries of clerks	$50,660.00	$40,660.00	$40,660.00
Postage stamps	1,069.00	890.79	800.79
Stationery	4,108.00	3,973.32	3,873.32
Rent	7,500.00	7,500.00	7,500.00
Contingent expenses	7,417.49	7,231.75	7,085.42
Observation and report of storms	246,038.50	244,350.00	249,600.00
Maintenance, etc., telegraph lines	24,000.00	24,000.00	24,000.00
Pay of Signal Corps	247,301.51	225,391.50	223,680.00
Subsistence of Signal Corps	155,000.00	149,269.38	148,000.00
Regular supplies	61,784.40	56,706.87	57,151.85
Incidental expenses	3,833.75	772.00	772.00
Transportation	35,512.01	23,855.92	23,488.14
Barracks and quarters	85,608.00	87,705.17	85,440.00
Clothing, camp, etc., equipage	2,873.89		
Medical department	7,100.00	3,523.03	3,200.00
Ordnance supplies	100.00		
Printing and binding	14,000.00	15,151.50	10,000.00
Expenses Signal Service	5,500.00	3,000.00	8,000.00
Capes Charles-Henry cable		20,000.00	
Repair Columbia River cable			5,500.00
Point Reyes Telegraph Line			4,974.75
Observation, etc., Arctic seas	14,549.17		
Signal stations, Nantucket Island	20,000.00		9,944.00
American Graphic Company, for maps	5,750.00		
Total	989,705.72	913,981.23	913,670.27

Designation of appropriation.	1889.	1890.	1891.
Salaries of clerks	$126,535.00	$153,960.00	$154,893.70
Postage stamps	834.15	500.49	500.49
Stationery	3,823.32	3,500.00	3,200.00
Rent	7,500.00		
Contingent expenses	6,348.23	16,750.00	6,570.00
Observation and report of storms	224,480.70	220,639.33	223,009.32
Maintenance, etc., telegraph lines	23,713.82	23,000.00	25,155.00
Pay of Signal Corps	193,710.03	354,856.19	357,952.00
Subsistence of Signal Corps	116,728.83		
Regular supplies	48,028.96	9,200.00	4,599.68
Incidental expenses	775.17	332.00	175.00
Transportation	22,618.24	19,000.00	17,000.00
Barracks and quarters	61,094.93		
Clothing, camp, etc., equipage			
Medical department	2,750.00	2,627.20	2,600.00
Ordnance supplies			
Printing and binding	10,000.00	10,000.00	10,000.00
Expenses Signal Service	5,000.00	5,000.00	10,000.00
Capes Charles-Henry cable			
Repair Columbia River cable			
Point Reyes Telegraph Line		1,740.00	
Observation, etc., Arctic seas			
Signal station, Nantucket Island			
American Graphic Company, for maps			
Total	856,995.38	821,105.21	815,655.19

The foregoing table shows that the annual maintenance of the Service has decreased regularly from year to year, and that the aggregate appropriations for the fiscal year ended June 30, 1891, were $174,050.53 less than those made for the fiscal year ended June 30, 1886.

There are three items under public acts which do not fall within the charge of yearly maintenance. An appropriation of $17,000 for the construction of a telegraph line in Florida and of $6,800 for the Tatoosh Island Telegraph Line entailed extra burdens for yearly maintenance of these lines, but such natural increase of yearly expenses has been offset by the purchase of a building in Washington for the Weather Bureau, whereby the item of $7,500 for rent will be hereafter unnecessary.

EXPENDITURES AUTHORIZED.

Owing to the fact that there were one hundred and eighty-seven regular and three hundred and forty-one special stations scattered over the entire territory of the United States, the number of accounts for small amounts necessary in the disbursement of the several appropriations controlled by this office aggregates nearly ten thousand per annum.

Under the old system each account required the autograph approval of the Chief Signal Officer, and as they were rendered in duplicate, such a requirement imposed a great physical labor upon the head of the Bureau, to obviate which it was suggested by this office and concurred in by the accounting officers of the Treasury to permit the Chief Signal Officer to issue at the beginning of each fiscal year special orders authorizing certain expenditures at the various stations during the ensuing fiscal year: these special orders were so prepared as to classify expenditures of like character, and to cover as well as to limit all items of expense (known as fixed charges) likely to be incurred during the year for the proper maintenance of the station: one copy of each order is filed with the first account rendered and thereafter referred to on all subsequent accounts. These orders, besides avoiding the enormous and to a certain extent purely perfunctory labor of approving each account, have been found to be of great advantage, as a means of ready reference, in the expeditious audit and settlement of accounts, it being extremely rare, and usually due to circumstances over which the office has no control, that the payment of an account is not made within four days after its receipt at this office. Checks in payment of the monthly compensation of the enlisted men of the Signal Corps and the civilian employés on duty outside of Washington, D. C., have been mailed to them on the very day on which the pay was due. To still further reduce the number of accounts a form of service and pay roll was devised by which all the civilian employés at special stations under a center would be borne upon one roll, by which plan a reduction of over five hundred separate accounts per annum has been effected.

REQUISITIONS AND ORDERS.

There were made during the year on the supply division of the War Department the following requisitions:

For stationary	92
For miscellaneous articles	149
For books and periodicals	23
Total	264

There were also issued the following:

Orders on contractors	530
Letters of authority to stations	1,118
Total	1,648

CONTRACTS.

As required by the act of Congress approved April 21, 1808 (Statutes at Large, vol. 2, p. 435), I submit herewith a list of contracts and leases made during the fiscal year ended June 30, 1891:

With whom made.	Place.	Contract or lease.	For what purpose.
The Sedgwick Building Investment Co.	Wichita, Kans	Lease	Rent of office.
Henry Ash	Palestine, Tex	do	Do.
Thomas Sweeny	Rapid City, S. Dak	do	Do.
P. J. Allen	Valentine, Nebr	do	Do.
J. F. Braum	Vicksburg, Miss	do	Do.
Chamber of Commerce.	Sioux City, Iowa	do	Do.
G. M. Hall	Pueblo, Colo	do	Do.
James Baker	Springfield, Mo	do	Do.
E. D. Franz	Santa Fé, N. Mex	do	Do.
S. Marks & Co	Roseburg, Oregon	do	Do.
Wm. G. Tucker	Port Angeles, Wash	do	Do.
E. J. Brooks & Co	New York City	Contract	Newspaper wrappers.
G. W. Schmidt	Pittsburg, Pa	Lease	Rent of office.
Hale, Dingley & Co	Montgomery, Ala	do	Do.
D. S. Hutchinson	Titusville, Fla	do	Do.
Walla Walla Lodge, No. 56, I. O. O. F.	North Platte, Nebr	do	Do.
M. E. Conway	Narragansett Pier, R. I.	do	Do.
N. Cramer, administrator.	Manistee, Mich	do	Do.
New Haven Investment Company.	New Haven, Conn	do	Do.
Geo. S. Waite	Key West, Fla	do	Do.
O. P. Helm	Huron, S. Dak	do	Do.
Abbie S. Ingalls	Indianapolis, Ind	do	Do.
R. McLaughlin	Jacksonville, Fla	do	Do.
W. J. Nesbitt	Micco, Fla	do	Do.
First National Bank	Sault de Ste. Marie	do	Do.
Catharine Wilson	Los Angeles, Cal	do	Do.

With whom made.	Place.	Contract or lease.	For what purpose.
Vanderbilt University.	Nashville, Tenn	do	Rent of office.
First National Bank	Portland, Me	do	Do.
County Commissioners.	Winnemucca, Nev	do	Do.
Pythian Land and Building Association.	Astoria, Oreg	do	Do.
L. G. Nesmith	San Diego, Cal	do	Do.
Sarah E. Allen	Tampa, Fla	do	Do.
Cotton Exchange	Galveston, Tex	do	Do.
Board of Trade	Little Rock, Ark	do	Do.
Jno. L. Mitchell (Ex.)	Milwaukee, Wis	do	Do.
Anna M. Grover	Keeler, Cal	do	Do.
Albert Marty	Kansas City, Mo	do	Do.
A. E. Rouiller	Lava, N. Mex	do	Do.
Real Estate and Law Building Co.	Atlantic City, N. J	do	Do.
S. C. Ashby & Co	Helena, Mont	do	Do.
First National Bank	Moorhead, Minn	do	Do.
M. G. Copeland & Co	Washington City	Contract	Flags.
Chamber of Commerce.	St. Paul, Minn	Lease	Rent of office.
Isabelle Waples	Savannah, Ga	do	Do.
J. C. Entwistle	Washington City	Contract	Printing and lithographing supplies.
R. J. McLean	do	do	Lumber.
Chadwick Copying Book Co.	Lambertville, N. J	Contract	Stationery.
J. Gordon Payne, attorney.	Lynchburg, Va	Lease	Rent of office.
A. G. Elliott & Co	Philadelphia, Pa	Contract	Paper, envelopes, etc.
Easton & Rupp	Washington, D. C	do	Do.
Capital Printing Co	do	do	Do.
Pythian Land and Building Association.	Astoria, Oregon	Lease	Rent of office.
James Phelan	San Francisco, Cal	do	Do.
The E. S. Greeley & Co.	New York City	Contract	Telegraph supplies.
J. B. Prescott & Son	Webster, Mass	do	Do.
Royce & Marean	Washington, D. C	do	Do.
Clendenin Bros	Baltimore, Md	do	Do.
Fresno Loan and Saving Bank.	Fresno, Cal	Lease	Rent of office.
J. D. Free, jr	Washington, D. C	Contract	Typewriting and stencil duplicate supplies.
Capital Printing Co	do	do	Do.
Redding Ink and Duplicator Co.	Newark, N. J	do	Do.
Hanna S. Simmons	Red Wing, Minn	Lease	Rent of office.
Cotton Exchange Building Co.	Memphis, Tenn	do	Do.
Sol. Spiegelberg	Santa Fé, N. Mex	do	Do.
J. B. Blalock	Spokane Falls, Wash	do	Do.
H. Overholser	Oklahoma City, Okla	do	Do.
W. E. Palmer	Carthage, N. Mex	do	Do.
Riley Watson	Valentine, Nebr	do	Do.
Ellen Hammond	Detroit, Mich	do	Do.
Paul Wilson	Pueblo, Colo	do	Do.

With whom made.	Place.	Contract or lease.	For what purpose.
Alliance Building Co.	Huron, S. Dak	Lease	Rent of office.
F. M. Brown & Co	New Haven, Conn	do	Do.
E. F. Halleck	Denver, Colo	do	Do.
Margaret Parmentier	Green Bay, Wis	do	Do.
Montana National Bank.	Helena, Mont	do	Do.
J. Gordon Payne and four others.	Lynchburg, Va	do	Do.
P. M. DeVitt	Abilene, Tex	do	Do.

RENEWAL OF LEASES.

The plan to include in the leases the various items of expense, such as heat, light, janitor's services, etc., incident to the hiring of offices, has worked most satisfactorily, not only in reducing the number of small accounts, but in securing a more efficient service at the stations.

Leases have been renewed for the fiscal year ending June 30, 1892, at the following-named stations:

Alpena, Mich.
Abilene, Tex.
Atlantic City, N. J.
Astoria, Oregon.
Baker City, Oregon.
Block Island, R. I.
Buffalo, N. Y.
Charleston, S. C.
Cleveland Ohio.
Cheyenne, Wyo.
Chicago, Ill.
Concordia, Kans.
Corpus Christi, Tex.
Columbus, Ohio.
Davenport, Iowa.
Detroit, Mich.
Dodge City, Kans.
Dubuque, Iowa.
Eastport, Me.
El Paso, Tex.
Eureka, Cal.
Fresno, Cal.
Fort Smith, Ark.
Galveston, Tex.
Green Bay, Wis.
Hatteras, N. C.
Helena, Mont.
Huron, S. Dak.
Indianapolis, Ind.
Jacksonville, Fla.
Kansas City, Mo.
Keeler, Cal.
Key West, Fla.
Leavenworth, Kans.
Los Angeles, Cal.
Lynchburg, Va.
Manistee, Mich.
Meridian, Miss.
Memphis, Tenn.
Milwaukee, Wis.
Micco, Fla.
Moorhead, Minn.
Montrose, Colo.
Nashville, Tenn.
New Haven, Conn.
North Platt, Nebr.
Norfolk, Va.
Oklahoma City, Okla.
Palestine, Tex.
Port Angeles, Wash.
Portland, Me.
Pueblo, Colo.
Rapid City, S. Dak.
Red Wing, Minn.
Red Bluff, Cal.
Roseburg, Oregon.
Savannah, Ga.
Santa Fé N. Mex.
San Diego, Cal.
Sault de Ste. Marie, Mich.
San Francisco, Cal.
Springfield, Mo.
Sioux City, Iowa.
Spokane Falls, Wash.
Tampa, Fla.
Titusvile, Fla.
Valentine, Nebr.
Vineyard Haven, Mass.
Walla Walla, Wash.
Wichita, Kans.
Winnemucca, Nev.

RECEIPTS AND SHIPMENTS.

The consolidation of the duties of the property clerk with those of the storekeeper has resulted in a great improvement in the methods followed in this branch of the work of the division, enabling a better record to be kept and a more expeditious handling of a large volume of business connected with the issue of property than was formerly the case.

In the packing and shipping room 15,649 distinct shipments have been made through the quartermaster's department by mail and by express, and 2,191 consignments received.

There were 58 requisitions remaining unfilled at the close of the fiscal year.

INVENTORIES OF PROPERTY.

Inventories of property have been taken several times during the year in order to verify by actual count the semiannual returns of property required by the regulations to be rendered. In addition to these inventories, the "Board on Separation of Property" requested that an inventory of property be taken on May 1, 1891, in order to enable the Board to make the report setting forth the quantities and kinds of property more suitable for the work of the Weather Bureau, and not necessary for the use of the Signal Corps, and what part of said property would be suitable and necessary for the Signal Corps, as required by section 10 of the act approved October 1, 1890. In view of the limited force in the division it became necessary to request the temporary assignment of two clerks to assist in making this latter inventory, which was begun on May 1, 1891, and finished on May 5, 1891.

While the inventory was being taken it was considered advisable to separate, as far as possible, the different classes of property, placing together all that pertained to military telegraph lines and that which pertained to military signaling, so that in the transfer of the property as little delay as possible would be experienced in handling it. The property at this office is now so arranged that very little, if any, difficulty will be experienced in separating it into its different classes as required by the section referred to.

PROPERTY ACCOUNTABILITY.

Under the act of Congress approved October 12, 1888, regulations, approved by the honorable the Secretary of War, were promulgated for the care of, preservation of, and accountability for, all Signal Service property. As the act of October 12, 1888, has not been modified or repealed by any subsequent legislation, it is assumed that it still remains in force and the regulations issued thereunder (above referred to) will govern so far as the property relating to the Weather Bureau is concerned, until modified or repealed by the Secretary of Agriculture. Attention is invited to this matter at this time in view of the fact that by the transfer of the Weather Service to the Department of Agriculture the status of the enlisted men of the Service changed on July 1, 1891.

SALES OF CONDEMNED PROPERTY.

The following statement shows the amounts received from sales at auction of condemned property, the dates upon which sold, and the stations at which the sales took place. The several amounts received were regularly covered into the Treasury of the United States, as required by law:

Date.	Station.	Articles.	Amount.
1890.			
Nov. 1	Boisé City, Idaho	Office furniture, stove, etc.	$8.75
Nov. 10	Dubuque, Iowa	Wind vane	.30
Oct. 23	Whipple Barracks, Ariz.	Sundry articles	79.15
Nov. 21	Des Moines, Iowa	Office furniture	No bid.
Nov. 22	Keokuk, Iowa	do	.25
Oct. 14	Fort Gibson, Ind. T	Wire	10.00
Nov. 29	Davenport, Iowa	Gas fixtures	No bid.
Oct. 4	Fort Elliott, Tex	Line material, tools, etc	4.50
Dec. 12	Memphis, Tenn	Office furniture	7.25
Dec. 17	Galveston, Tex	do	25.25
Dec. 19	Chattanooga, Tenn	Stove	1.23
Dec. 6	Colorado Springs, Colo	Office furniture	5.00
Dec. 15	Lava, N. Mex	Stove	4.50
Dec. 23	St. Vincent, Minn	Office furniture	31.60
1891.			
Jan. 13	Springfield, Mo	Stove	1.00
Jan. 31	Lexington, Ky	Office furniture, flagstaff	2.05
Feb. 5	Rochester, N. Y	Office furniture	5.70
Feb. 10	La Crosse, Wis	do	2.00
Feb. 6	Oswego, N. Y	do	4.00
Mar. 30	Charlotte, N. C	do	2.25
Apr. 20	Dodge City, Kans	Letter press	.50
May 6	Corpus Christi, Tex	Office furniture	No bid.
May 20	Augusta, Ga	do	6.85
June 11	Palestine, Tex	do	2.00
May 30	Vancouver Barracks, Wash	Field glasses and telescopes	11.50
June 4	Marquette, Mich	Office furniture	7.50
May 4	Nashville, Tenn	Chairs	No bid.
May 13	Lynchburg, Va	Office furniture	6.89
June 25	Office of Chief Signal Officer	Condemned property	96.75
	Total		326.77

TELEGRAPH LINES SOLD.

The number of miles of abandoned telegraph lines sold at auction during the year is 37; the amount received for the same is $31.25, which was properly deposited in the Treasury, as required by the regulations.

The lines sold are as follows:

Date.	From—	To—	Miles.	Amount.
1890.				
July 21	Fort Bridger, Wyo	Carter, Wyo	10	$5.25
Dec. 22	Fort Totten, N. Dak	Oberon, N. Dak	11	25.00
1891.				
Apr. 15	Fort Lowell, N. Mex	Tucson, Ariz	7	Abandoned
May 20	Fort Union, N. Mex	Watrous, N. Mex	9	1.00
			37	31.25

ACCOUNTS SETTLED.

The number of accounts, including those for the pay and commutations due the enlisted force, required in the disbursement of the various appropriations under the control of this office and settled during the year is 9,638, distributed as follows:

Months.	Bill book.	Commutation accounts, pay book.	Months.	Bill book.	Commutation accounts, pay book.
1890.					
July	484	326	February	529	286
August	441	325	March	362	284
September	347	323	April	742	275
October	709	319	May	419	270
November	429	313	June	423	260
December	459	305			
1891.			Total	6,058	3,580
January	714	294			

ACCOUNTS UNSETTLED.

On June 30, 1891, there were in the division 398 unsettled accounts, including 46 which had been returned to payees for correction, etc., and have not been received back. Of the 353 accounts remaining in the division 41 were bills of the Western Union Telegraph Company, which could not be disposed of owing to demurrer on the part of said company to the rates fixed by the Postmaster-General for the fiscal year ended June 30, 1891, and 311 were held for certain data to enable a proper audit to be made, and for other reasons which prevented them from being put in course of settlement. There were no accounts in the division on June 30, 1891, available for settlement.

ACCOUNTS OUTSTANDING.

The board appointed under section 10 of the act of October 1, 1890, to report upon the division of property and money between the Signal Corps and the Weather Bureau, recommended, and the recommendation was approved by the Secretary of War, that all debts incurred by the Signal Service prior to July 1, 1891, and remaining outstanding and unpaid on that date, be settled by the disbursing officer of the Signal Service up to September 30, 1891; including accounts for transportation there were about 2,000 such accounts outstanding on June 30, 1891.

PAYMENT BY CHECK.

In order to avoid any question which might arise as to the fact of payment of an account, the system has been followed for several years of paying all accounts by checks, and the plan has proved most satisfactory. Paragraph 734 of the Army Regulations, 1889, requires that, "When disbursing officers draw checks in payment of accounts on funds placed to their credit, they will note upon the receipt or voucher taken for such payment, which will be of even date with the check, the number, date, and amount of the check given in payment, and designate the assistant treasurer or depository upon whom it is drawn;" this requirement, which has been strictly followed, besides being a most important safeguard, enables an inspecting officer to identify without doubt and without loss of time the check drawn in payment of any account. The number of checks drawn during the year in the payment of accounts is 9,203, of which number 3,580 were required to pay amounts due the enlisted force; and it is worthy of note, as indicating the security of the method, that during the year out of this large number of checks only 4 have been lost in transit.

INSPECTION OF MONEY ACCOUNTS.

My money accounts have been inspected and the balances verified by the Inspector-General's Department, as follows: November 29, 1890, by Joseph P. Sanger, major and inspector-general.

SUSPENSION OF MONEY ACCOUNTS.

Several difference sheets, referring to my accounts, were received during the year. Replies have been made covering all accounts suspended up to date by the Third Auditor; also all accounts suspended up to December 31, 1889, by the Second Auditor.

The difference sheet received from the Second Auditor, embracing the period from January 1, 1890, to December 31, 1890, inclusive, has not yet been answered, as certain information needed, upon which the answer depended, had to be called for and has not as yet been furnished; it is expected that answer will be completed, however, within a very few days.

SALES OF PUBLICATIONS.

Three hundred and fifty-nine dollars and eighty-seven cents have been received during the year from the sale of maps and bulletins, as allowed by the act of Congress approved March 30, 1874 (section 227, Revised Statutes). The amount was deposited with the Treasurer of the United States to the credit of the appropriation "Observation and Report of Storms," for the then current fiscal year.

ALLOTMENTS FOR CONTINGENT EXPENSES AND STATIONERY.

Contingent expenses: In submitting the estimates for the fiscal year ended June 30, 1891, the item of contingent expenses for this Bureau was separately estimated for, aggregating the sum of $10,487.50, excluding the sum of $9,585 for heating apparatus and for repairs to buildings and preservation of grounds.

Chief Engineer Williamson, the superintendent of the State, War, and Navy Department buildings, and the superintendent of the Signal Office buildings, had reported that there would be required for the fiscal year ended June 30, 1891, for fuel, $1,100; gas, $375, and repairs and miscellaneous items, $650. The Secretary of War was therefore asked to give such orders in the allotment of the appropriations as would insure an equitable distribution of the same among the various Bureaus, taking into consideration the exceptional items of fuel, light, and repairs for Bureaus unprovided for by special appropriation.

The amount allotted to this Bureau under the circular of July 12, 1890, was only $6,570. It therefore became necessary to use the utmost economy to avoid creating a deficiency in this item.

Stationery: In submitting the estimates for the fiscal year ended June 30, 1891, the item of stationery for this Bureau aggregated the sum of $6,250. The sum allotted by the circular of July 12, 1890, was $3,200, not including the 10 per cent reserve fund.

The amount allotted by the Secretary of War under this item for the fiscal year ended June 30, 1890, was $3,500, which sum was found to be absolutely inadequate to supply the needs of the Bureau for the proper transaction of public business, and the Chief Signal Officer has been forced, in order that the public business might not suffer, to resort to many shifts and expedients not allowed by law but required, under the circumstances, in order that the important public interests intrusted to his care might not be embarrassed. The estimate for the fiscal year ended June 30, 1891, was based upon the actual consumption during the year ended June 30, 1890. In order to keep within the amount allotted, it has been necessary to practice the greatest economy.

CONDITION OF APPROPRIATIONS.

One of the methods devised and successfully followed during the past seven years, has been that of keeping an exact record of all liabilities incurred, by which it has been possible to ascertain at once the status of any of the appropriations disbursed by the office. This record is not made up of vague and uncertain approximations and estimates as to outstanding debts, but follows a regular system by which no account is incurred without the exact amount involved being first ascertained, and the sum necessary to pay the account when presented is set aside for the purpose, and a formal order made out, thereby avoiding any possibility of creating a deficiency or involving the Government in any contract for a future payment of money in excess of the appropriations available; the record has been of incalculable value in the efficient administration of the work imposed by law upon the Chief Signal Officer, especially so in the item of transportation.

In addition to this record of liabilities incurred, a cash book, as required by paragraph 1319, Army Regulations 1889, is kept, in which is entered, according to appropriations, all amounts received and disbursed; the date thereof, from whom received, or to whom paid, and on what account. Each day the balances, as shown by said cash book, are verified by comparison with the check book, thus not only insuring absolute accuracy in those records but offering the greatest protection to the United States in the disbursement of the several appropriations.

The condition of the appropriations for the fiscal year ended June 30, 1891, with the expenditures thereunder, balances, and probable demands on such balances, report of which is required to be rendered by the act of Congress, approved May 20, 1820, is as follows:

Appropriated:	
Clerks and messengers	$154, 893. 70
Printing and binding	10, 000. 00
Postage stamps (allotted by Secretary of War)	500. 49
Stationery (allotted by Secretary of War)	3, 200. 00
Contingent expenses (allotted by Secretary of War)	6, 570. 00
Signal Service of the Army	10, 020. 70
Observation and report of storms*	248, 545. 98
Signal Service pay, etc. †	429, 280. 84
Signal Service, regular supplies	4, 893. 79
Signal Service, incidental expenses	175. 00
Signal Service, transportation	17, 000. 00
Signal Service, medical department	2, 600. 00
Total amount appropriated	887, 680. 50
Expended:	
Clerks and messengers	152, 820. 88
Printing and binding	10, 000. 00
Postage stamps (allotted by Secretary of War)	492. 00
Stationery (allotted by Secretary of War)	3, 200. 00
Contingent expenses (allotted by Secretary of War)	6, 570. 00
Signal Service of the Army	6, 391. 75
Observation and report of storms	113, 167. 59
Signal Service pay, etc	362, 734. 97
Signal Service, regular supplies	2, 385. 42
Signal Service, incidental expenses	116. 75
Signal Service, transportation	8, 622. 61
Signal Service, medical department	2, 246. 86

* This includes $1,710 deficiency appropriation, also $1,150.68 deducted and made available for "fuel at offices," under Signal Service regular supplies, for the first sixty days of the fiscal year.

† This includes a deficiency appropriation of $64,613.27.

Balances:	
Clerks and messengers	$2,072.82
Postage stamps (allotted by Secretary of War)	8.49
Signal Service of the Army	3.628.95
Observation and report of storms	135,378.39
Signal Service, pay, etc	66,545.87
Signal Service, regular supplies	2,508.37
Signal Service, incidental expenses	58.25
Signal Service, transportation	8.377.39
Signal Service, medical department	353.14
Probable demands:	
Signal Service of the Army	3,504.33
Observation and report of storms	116,431.92
Signal Service, pay, etc	66,545.87
Signal Service, regular supplies	1,027,51
Signal Service, incidental expenses	35.97
Signal Service, transportation	8,180.83
Signal Service, medical department	19.85

CIVILIANS EMPLOYED IN LIEU OF ENLISTED MEN

The following list shows the names of civilians and the compensation paid to each employed during the year. under the provision in section 8 of the act of Congress approved October 1, 1890, (Public—No. 352): "That any vacancy existing or hereafter occurring in that portion of the force of the Signal Corps engaged in said (meteorological) duties may be filled by a civilian at a salary not exceeding that now paid for the same class of work in the State or Territory where the service may be performed, and this compensation for said services shall continue until July first, eighteen hundred and ninety-one, which compensation may be paid out of the appropriation for the present enlisted force."

Names.	Date of employment.	Compensation.
	1890.	
N. S. Eddy	Oct. 5	$70.00
J. H. Sargent	Nov. 1	70.00
J. R. Frederick	Nov. 1	60.00
J. C. Piercy	Oct. 14	90.00
A. P. Butler	Nov. 1	55.00
P. F. Lyons	Oct. 29	90.00
G. M. Gartrell	Nov. 2	75.00
J. M. Sherier	Nov. 2	70.00
F. B. Proctor	Nov. 1	60.00
C. H. Richardson	Nov. 1	60.00
J. J. Gray	Nov. 20	80.00
W. W. Neifert	Nov. 27	65.00
Mary E. Crosby	Dec. 1	60.00
J. I. Widmeyer	Dec. 4	65.00
J. H. Clery	Dec. 4	85.00
J. P. Roche	Dec. 9	50.00
W. W. Dent	Dec. 14	85.00
F. E. Seegelken	Dec. 15	65.00
Geo. Reeder	Dec. 16	80.00
R. McKean Barry	Dec. 15	35.00
H. W. Ford	Dec. 21	70.00
L. M. Burkholder	Dec. 19	55.00
E. C. Vose	Dec. 22	80.00
H. Schneider	Dec. 23	70.00
C. F. Schneider	Dec. 28	65.00
	1891.	
W. E. Butler	Jan. 2	65.00
H. R. Patrick	Jan. 5	65.00
R. M. Crawford	Jan. 8	90.00
H. L. Ball	Jan. 15	75.00

Names.	Date of employment.	Compensation.
	1891.	
H. Groucher	Jan. 15	$65.00
H. W. Richardson	Jan. 19	65.00
W. T. Blythe	Jan. 15	70.00
R. Peters	Jan. 26	75.00
Geo. N. Lysight	Feb. 16	60.00
Paul Sanguinetti	Mar. 1	60.00
Thomas Callahan	Feb. 27	55.00
Geo. E. Grimes	Mar. 21	60.00
T. J. Flavin	Apr. 1	70.00
T. F. Townsend	Mar. 1	100.00
M. L. Hearne	Mar. 4	100.00
P. Connor	Mar. 4	90.00
R. McKean Barry	Mar. 26	65.00
M. Mahaney	Mar. 12	55.00
J. Sullivan	Mar. 12	50.00
J. W. Fraber	Mar. 12	70.00
G. Allen	Mar. 17	80.00
H. B. Dick	Mar. 18	60.00
W. J. Wambaugh	Mar. 20	65.00
Samuel A. Williams	Mar. 15	*2.00
G. M. Chappel	Mar. 30	85.00
F. Newman	Apr. 19	100.00
A. J. Davis	Apr. 20	85.00
Robert J. Bain	May 16	50.00
F. T. Williams	June 11	90.00
Peter P. Porter	May 16	50.00
James H. Dutton	May 18	50.00
G. H. Penrod	May 7	90.00
L. H. Murdoch	May 21	50.00
H. B. Boyer	May 25	100.00
R. O. Lazenby	May 27	65.00
W. L. Moore	June 11	92.50
H. McP. Baldwin	June 3	70.00
Mrs. M. E. Conway	June 10	60.00
E. B. Dunn	June 11	110.00
J. H. Robinson	June 19	115.00
John Robinson	June 1	75.00

* Per day.

CARPENTER SHOP.

In the carpenter shop the usual quantity of work has been done, consisting of jobbing and repairs about the office, and the two men employed have been busily engaged during the entire year.

SUPERINTENDENCE OF BUILDINGS.

Chief Engineer Thom Williamson, U. S. Navy, superintendent of the State, War, and Navy Department buildings, has continued in charge of the supervision of the buildings and grounds at the corner of Twenty-fourth and M streets, at which the Signal Office is located, and the efficient services rendered by him in connection with the matter are fully appreciated. In view of the transfer of the buildings to the Department of Agriculture on July 1, 1891, he was relieved of the duty by order of the Secretary of War on June 1, 1891.

CONDITION OF TWENTY-FOURTH STREET.

Notwithstanding the fact that effort was made to have the District Commissioners put in proper condition Twenty-fourth street, between Pennsylvania avenue and M street, said street is still in very bad order, and some action should be taken to have it concreted, as the street is much traveled by public and private vehicles.

TRANSFER TO THE DEPARTMENT OF AGRICULTURE.

By the operation of the "Act making appropriations for the Weather Bureau for the fiscal year ending June 30, 1892," that part of the work of the division which includes the preparation and settlement of money accounts will be performed under the immediate direction of the disbursing clerk of the Department of Agriculture. The force at present engaged upon this branch of the work consists of 3 clerks of class 1, and 1 clerk at $1,000. One of the clerks at $1,200 is the check clerk, and another the bill-book clerk.

SYSTEM OF BOOKKEEPING.

The system of bookkeeping practiced in the division for the past seven years is original with this office, it having been devised by the chief clerk of the division. The system, as devised, having been approved by the Chief Signal Officer, has been closely followed, with the result that every requirement of an exact and, at the same time, labor-saving record has been secured.

One of the features since incorporated in the system has been the use of a bill-book, which was adopted with a view of curtailing the work of recording in the letter series (as had been previously done) the large number of accounts received. The book contains a record of every account received, showing (by means of properly ruled and headed columns) the serial number, the date of receipt, the name of creditor, the station at which incurred, the nature of the account, the amount, the appropriation out of which payable, to whom and when sent for audit, when returned, date vouchers sent for signature, date of return, and description of the check drawn in payment, so that there is presented a graphic trace of the successive steps through which every account passes from its receipt to its payment. The serial numbers of accounts have been consecutive since the book was opened in January, 1888, and shows that there have been received from that date to June 30, 1891, 22,928 accounts, being an average of 546 per month, not including the monthly pay accounts of the 320 enlisted men of the Signal Corps, which are not entered in the bill-book, and which would increase the average to 866 accounts per month.

PUBLICATIONS BRANCH.

The following is a summary of the work performed in the publications branch during the fiscal year ended June 30, 1891:

From July 1, 1890, to June 13, 1891, the publications division was operated as an independent division, being at different times, during that period, in charge of First Lieut. R. E. Thompson, Capt. Robert Craig, Capt. James Allen, Second Lieut. B. M. Purssell, Capt. Charles E. Kilbourne, and Second Lieut. James Mitchell. Under instructions No. 13, dated Signal Office, War Department, Washington City, June 13, 1891, the publications division was attached as a subdivision of the supply and miscellaneous division.

The work of the publications division, including the correspondence, has been carried on during the year with that precision that has characterized it in the past. The improvements inaugurated to facilitate the distribution of the publications of the Service, referred to in the last annual report, have not only continued to give entire satisfaction, but have fully demonstrated the wisdom of their adoption.

The current work has been promptly and efficiently performed, besides being kept up to the usual standard of excellence. In addition thereto, a large amount of special printing, consisting largely of back data, has been executed.

The annual report of the Chief Signal Officer for the fiscal year ended June 30, 1890, has been received from the Public Printer, and distributed to the regular and voluntary observers of the Service, and the foreign and domestic libraries.

The number of requisitions made on the Public Printer for printing and binding for the Service during the fiscal yeal, is 101, all of which, with few exceptions, have been completed.

No material change has been made in the personnel during the year.

The following statement shows the number of letters received and sent, relating to the publications of the office, and the title and number of publications distributed:

Letters received	2,573
Letters sent	1,154
Circular letters sent	676
Annual reports distributed	5,072
Advance reports distributed	1,400
Professional Papers distributed	427
Signal Service Notes distributed	309
Bound Monthly Weather Reviews	346
Monthly Weather Reviews	30,000
Bound Signal Service Notes	48
Bound Professional Papers	14
Bound daily international charts	10
Bound daily weather maps	20
Climate of Nebraska, Washington, and Rainfall on the Pacific Slope and the Western States and Territories for from two to forty years	579
Stages of the Ohio Rivers and Principal Tributaries, 1857-1889	32
Stages of the Mississippi River and of its Principal Tributaries, except the Ohio River, 1860-1889	46
Stages of Water at Miscellaneous River Stations in California, Oregon, and North Carolina, 1875-1889	28
Arctic Publications	165
Mean Temperatures and Their Corrections in the United States (Charts).	300
Charts showing the isobars, isotherms, and winds in the United States for each month from January, 1871, to December, 1873	135
Bibliography of Metereology, Winds, Part III	122
8 a. m. daily weather maps	110,783
8 p. m. daily weather maps	81,060
Daily international charts, July 1, 1884, to December 31, 1884	15,000
Crop Bulletins	10,450
Miscellaneous publications, pamphlets, etc. (estimated)	11,000
Monthly Summary, International	350

The following shows the quantity (number of impressions) of printing and lithographing performed during the year:

Printing.

Crop Bulletins	10,450
Circulars	2,290
Envelopes	22,550
Forms	168,435
General and Special Orders	17,560
Letters	26,910
Letter heads	53,880
Monthly Weather Review	278,675
Monthly Summary	11,750
Miscellaneous	85,000
Wrappers	85,000
Total	862,500

Lithographing.

Base maps	299,047
Daily (8 a. m. and 8 p. m.) weather charts	191,846
Drawings and specifications	1,325
Forms and circulars	97,015
Monthly Weather Review charts	99,753
Miscellaneous charts	34,665
Weather Crop Bulletin	16,373
Total	740,024

Very respectfully,

ROB'T CRAIG,
Captain Signal Corps, Disbursing Officer.

THE CHIEF SIGNAL OFFICER,
Washington, D. C.

APPENDIX 12.

CHANGES IN SIGNAL-SERVICE STATIONS AND ANNUAL METEOROLOGICAL SUMMARIES FOR 1890.

SIGNAL-SERVICE STATIONS, 1889.—LATITUDE, LONGITUDE, ELEVATION OF BAROMETERS, THERMOMETERS, AND RAIN GAUGES, LOCAL TIME, AND CHANGES DURING THE YEAR.

Stations.	Latitude.		Longitude.		Elevation December 31, 1890.			Local time, *faster* or *slower* than eastern time.		Changes in elevation of barometers from January 1, 1890, to June 30, 1891.
					Barometer above sea.	Thermometer above ground.	Rain gauge above ground.			
	°	'	°	'	*Feet.*	*Feet.*	*Feet.*	*h.*	*m.*	
Abilene	32	23	99	40	1,748	64	53	1	39s	
Albany	42	39	73	45	85	84	99	0	5F	
Alpena	45	5	83	30	609	63	54	0	34s	
Assinaboine	48	32	109	42	2,690	16	2	2	19s	
Astoria	46	57	124	0	--------	39	56	3	15s	
Atlanta	33	45	84	23	1,139	98	95	0	37s	Moved May 31, 1891, to 1,131 feet.
Atlantic City	39	22	74	25	53	68	57	0	3F	
Augusta	33	28	81	54	183	45	40	0	27s	Moved May 1, 1891, to 209 feet.
Baker City	44	50	117	50	3,430	49	38	2	51s	
Baltimore	39	18	76	37	76	86	78	0	6s	Moved June 1, 1891, to 179 feet.
Bismarck	46	47	100	38	1,681	16	2	1	42s	Moved June 30, 1891, to 1,698 feet.
Block Island	41	10	71	36	27	39	33	0	14F	
Boisé City	43	37	116	12	2,750	43	36	2	45s	Closed June 30, 1890.
Boston	42	21	71	4	125	115	174	0	16F	
Brownsville	25	53	97	26	57	17	1	1	30s	
Buffalo	42	53	78	53	690	103	93	0	15s	
Buford	48	0	103	56	1,900	17	3	1	56s	
Cairo	37	0	89	10	359	88	78	0	56s	
Canby	46	16	124	4	179	10	2	3	16s	
Carson City	39	10	119	46	--------	21	42	2	59s	
Charleston	32	47	79	56	52	60	55	0	20s	
Charlotte	35	13	80	51	808	56	47	0	23s	Moved April 1, 1891, to 773 feet.

Chattanooga	35	4	85	15	783	71	60	0	41s	
Cheyenne	41	8	104	48	6,105	58	50	1	59s	
Chicago	41	52	87	38	824	241	238	0	50s	Moved February 1, 1890, from 715 feet.
Cincinnati	39	6	84	30	628	153	145	0	38s	
Cleveland	41	31	81	42	751	97	89	0	27s	
Colorado Springs	38	51	104	47	------	10	2	1	59s	
Columbia	------	------	------	------	763	4	1	1	9s	
Columbus	39	58	83	0	837	94	76	0	32s	
Concordia	39	35	97	41	1,410	42	34	1	31s	
Corpus Christi	27	49	97	25	20	43	34	1	30s	
Custer	45	42	107	34	3,040	18	26	2	10s	
Davenport	41	30	90	38	613	100	93	1	2s	Moved April 1, 1890, from 615 feet.
Denver	39	45	105	0	5,281	86	79	2	0s	Moved May 1, 1891, to 5,287 feet.
Des Moines	41	35	93	37	869	84	75	1	14s	
Detroit	42	20	83	3	724	158	(?)	0	32s	Moved November 15, 1890, from 662 feet.
Dodge City	37	45	100	0	2,523	44	37	1	40s	
Dubuque	42	30	90	44	651	60	50	1	3s	
Du Chesne	40	35	109	50	4,900	12	4	2	19s	
Duluth	46	48	92	8	670	70	56	1	8s	Moved April 1, 1891, to 656 feet.
Eastport	44	54	66	59	53	51	43	0	32F	
Elliott	35	30	100	21	2,690	14	1	1	41s	Closed September 30, 1890.
El Paso	31	47	106	30	3,796	69	62	2	6s	
Erie	42	7	80	5	714	92	82	0	20s	
Eureka	40	48	124	11	64	60	52	3	17s	
Fort Smith	35	22	94	24	492	73	75	1	17s	Moved January 1, 1890, from 470 feet.
Fresno	36	43	119	49	338	78	66	2	59s	Moved October 1, 1890, from 328 feet.
Galveston	29	18	94	50	42	94	88	1	19s	
Grand Haven	43	5	86	13	621	55	47	0	45s	
Grant	32	39	109	57	4,916	15	4	2	20s	
Green Bay	44	31	88	0	616	49	42	0	52s	Moved May 1, 1891, to 617 feet.
Green Mountain	44	15	68	15	1,541	12	3	0	27F	Maintained during summer only.
Harrisburg	40	16	76	52	377	94	87	0	7s	Moved January 11, 1890, from 361 feet.
Hatteras	35	15	75	40	11	17	2	0	2s	
Helena	46	34	112	4	4,069	64	51	2	28s	Moved May 2, 1891, to 4,118 feet.
Huron	44	21	98	9	1,307	47	39	1	32s	Moved May 1, 1891, to 1,310 feet.
Indianapolis	39	46	86	10	766	76	72	0	44s	
Jacksonville	30	20	81	39	43	69	56	0	26s	
Jupiter	26	57	80	7	28	13	1	0	20s	
Kansas City	39	5	94	37	963	78	81	1	18s	Moved May 1, 1890, from 947 feet.

SIGNAL-SERVICE STATIONS, 1890.—LATITUDE, LONGITUDE, ELEVATION OF BAROMETERS, THERMOMETERS, AND RAIN GAUGES, ETC.—Continued.

Stations.	Latitude.		Longitude.		Elevation December 31, 1890.			Local time, *faster* or *slower* than eastern time.		Changes in elevation of barometers from January 1, 1890, to June 30, 1891.
					Barometer above sea.	Thermometer above ground.	Rain gauge above ground.			
	°	′	°	′	*Feet.*	*Feet.*	*Feet.*	*h.*	*m.*	
Keeler	36	35	117	50	3,622	20	20	2	51s	
Keokuk	40	22	91	26	613	63	56	1	6s	
Key West	24	34	81	49	22	41	44	0	27s	
Knoxville	35	56	83	58	980	80	71	0	36s	
La Crosse	43	49	91	15	736	70	61	1	5s	Moved May 2, 1890, from 744 feet.
Lansing	42	44	84	32	883	44	41	0	38s	
Leavenworth	39	19	94	57	842	56	50	1	20s	
Lexington	38	2	84	33	1,040	75	67	0	38s	
Little Rock	34	45	92	6	309	75	54	1	8s	
Los Angeles	34	3	118	15	330	74	66	2	53s	
Louisville	38	15	85	45	551	100	103	0	43s	
Lynchburg	37	25	79	9	685	82	76	0	16s	Moved April 1, 1890, from 658 feet.
Manchester	42	58	71	28	247	76	68	0	14F	
Manistee	44	13	86	16	615	43	28	0	45s	
Marquette	46	34	87	24	735	68	56	0	49s	
McKinney	43	48	106	10	5,000	15	36	2	5s	
Memphis	35	9	90	3	330	108	100	1	0s	Moved November 1, 1890, from 348 feet.
Meridian	32	21	88	41	358	53	42	0	55s	
Milwaukee	43	2	87	54	699	106	100	0	51s	Moved March 9, 1890, from 697 feet.
Mobile	30	41	88	2	35	87	81	0	52s	
Montgomery	32	23	86	18	217	68	60	0	45s	
Montrose	38	30	107	56	5,795	43	34	2	12s	
Moorhead	46	52	96	44	935	54	44	1	27s	Moved July 1, 1890, from 926 feet.
Mount Killington	43	38	72	49	4,056	6	3	0	9F	Maintained during summer only.
Mount Washington	44	16	71	18	6,279	6	2	0	15F	Maintained during summer only.
Nantucket	41	17	70	6	14	43	38	0	20F	
Nashville	36	10	86	47	553	96	83	0	47s	

New Haven	41	18	72	56	107	118	110	0	8F	
New London	41	21	72	5	47	29	58	0	12F	
New Orleans	29	58	90	4	54	112	111	1	0s	
New York City	40	43	74	0	185	183	155	0	4F	
Norfolk	36	51	76	17	43	88	80	0	5s	Moved January 24, 1890, from 69 feet.
Northfield	44	10	72	41	872	15	2	0	9F	Moved January 14, 1890, from 871 feet.
North Platte	41	8	100	45	2,841	45	34	1	43s	
Oklahoma City	35	26	97	33	1,239	54	45	1	30s	Opened November 1, 1890.
Olympia	47	3	122	53	36	46	41	3	11s	
Omaha	40	16	95	56	1,113	88	82	1	24s	
Oswego	43	29	76	35	335	76	83	0	6s	
Palestine	31	45	95	40	511	42	38	1	22s	
Parkersburg	39	16	81	36	638	76	67	0	26s	
Pensacola	30	25	87	13	56	79	80	0	49s	
Philadelphia	39	57	75	9	117	168	166	0	0	
Pittsburg	40	32	80	2	847	130	124	0	20s	
Port Angeles	48	7	123	6	14	20	2	3	14s	
Port Huron	43	0	82	26	639	70	63	0	30s	
Portland, Me	43	39	70	15	99	81	71	0	19F	
Portland, Oregon	45	32	122	43	80	85	77	3	11s	
Pueblo	38	18	104	36	4,753	23	13	1	58s	Moved March 1, 1891, to 4,734 feet.
Raleigh	35	47	78	38	388	70	2	0	14s	Moved April 1, 1890, from 375 feet.
Rapid City	44	4	103	12	3,280	49	44	1	53s	
Red Bluff	40	10	122	15	342	54	44	3	9s	
Red Wing	44	34	92	38	758	63	55	1	10s	Opened October 19, 1890.
Rio Grande City	26	23	98	48	230	11	3	1	35s	
Rochester	43	8	77	42	622	129	125	0	11s	Moved February 10, 1891, to 523 feet.
Roseburg	43	13	123	20	523	54	47	3	13s	
Sacramento	38	35	121	30	64	61	57	3	6s	
St. Louis	38	38	90	12	571	107	99	1	1s	
St. Paul	44	58	93	3	831	114	108	1	12s	
St. Vincent	48	56	97	14	804	16	15	1	29s	
Salt Lake City	40	46	111	54	4,348	90	77	2	27s	
San Antonio	29	27	98	28	781	17	1	1	34s	
San Diego	32	43	117	10	93	73	66	2	49s	
Sandusky	41	25	82	40	629	64	55	0	30s	
San Francisco	37	48	122	26	109	109	101	3	10s	Moved September 4, 1890, from 60 feet.
Santa Fé	35	41	105	57	7,026	35	29	2	4s	
Sault de Ste. Marie	46	28	84	22	642	56	48	0	37s	

SIGNAL-SERVICE STATIONS, 1890.—LATITUDE, LONGITUDE, ELEVATION OF BAROMETERS, THERMOMETERS, AND RAIN GAUGES, ETC.—Continued.

Stations.	Latitude.		Longitude.		Elevation December 31, 1890. Barometer above sea.	Thermometer above ground.	Rain gauge above ground.	Local time, *faster* or *slower* than eastern time.		Changes in elevation of barometers from January 1, 1890, to June 30, 1891.
	°	′	°	′	*Feet.*	*Feet.*	*Feet.*	*h.*	*m.*	
Savannah	32	5	81	5	87	66	56	0	24s	
Shreveport	32	30	93	40	249	77	76	1	14s	
Sill	34	40	98	23	1,200	10	3	1	33s	
Sioux City	42	29	96	24	1,158	89	73	1	26s	
Spokane Falls	47	40	117	25	1,938	100	92	2	49s	Moved November 6, 1890, from 1,921 feet.
Springfield, Ill	39	48	89	39	644	80	64	0	58s	
Springfield, Mo	37	12	93	18	1,356	77	74	1	13s	
Stanton	33	30	105	26	6,150	17	2	2	2s	Moved February 28, 1891, to 6,152 feet.
Sully	44	39	100	39	1,600	16	2	1	42s	
Tampa	27	57	82	27	36	45	36	0	30s	Opened March 13, 1890.
Titusville	28	34	80	51	44	16	15	0	23s	
Toledo	41	40	83	34	674	122	113	0	34s	
Valentine	42	50	100	32	2,613	41	31	1	42s	
Vicksburg	32	22	90	53	222	60	54	1	3s	
Walla Walla	46	2	118	20	1,018	66	56	2	53s	
Washakie	43	1	108	54	5,580	23	16	2	16s	
Washington City	38	53	77	1	112	59	42	0	8s	
Whipple Barracks (Prescott)	34	33	112	28	5,389	11	3	2	30s	Closed October 16, 1890.
Wichita	37	41	97	20	1,366	78	71	1	29s	
Wilmington	34	14	77	57	78	82	76	0	12s	Moved July 1, 1890, from 52 feet.
Winnemucca	40	58	117	43	4,340	62	54	2	51s	
Woods Holl	41	33	70	40	22	51	39	0	17F	
Yankton	42	54	97	28	1,232	50	42	1	30s	Moved January 7, 1890, from 1,234 feet; moved April 1, 1891, to 1,280 feet.
Yuma	32	45	114	36	141	16	1	2	38s	

APPENDIX 13.

PREFACE.

These tables contain meteorological data for the year ending December 31, 1890. Observations have been made at 8 a. m. and 8 p. m., seventy-fifth meridian time (which standard time is always understood unless otherwise stated), and with standard instruments in all cases.

Each station is yearly inspected, at least once and the barometers compared with an instrument previously tested with the standard at the Washington office. Comparative barometer readings are also made of the two or more barometers at the several stations at the end of each month, and forwarded to the central office for examination.

The thermometers sent to the stations are first carefully tested within the range of temperature which obtains at each station and while in use frequent comparisons are made between the readings of the dry, and wet, dry and maximum, etc. The remaining instruments are likewise of standard make, and are verified from time to time.

The following explanation is given as to the several columns, the headings of which do not show clearly the method of obtaining the data entered therein.

PRESSURE.

The mean pressure is the average of readings at 8 a. m. and 8 p. m.; the range is the difference between the highest and lowest individual readings for the month.

TEMPERATURE.

The extremes of temperature are, as near as can be obtained, for the civil day, midnight to midnight. The self-registering thermometers are read at both observations, 8 a. m. and 8 p. m.; the maximum thermometer is set at 8 a. m. only; the minimum thermometer is set at 8 p. m. only. In cases of doubt as to the conditions which obtained at midnight, the self-recording thermographs are consulted at all stations equipped with such instruments.

The daily mean is obtained by taking the sum of the maximum and the minimum temperature and dividing by two (2).

CLOUDS.

The mean cloudiness is determined from frequent eye observations during the day.

WIND.

All wind velocities are for five-minute periods. The prevailing direction is obtained from eye observations at 8 a. m. and 8 p. m., as entered in the columns "North," "Northeast," etc.

NUMBER OF DAYS.

A cloudless day is one on which an average of 0 to 3 tenths clouds has obtained; partly cloudy, 4 to 7 tenths; cloudy, 8 to 10 tenths.

A rainy day is one on which .01 inch or more rain, snow, sleet, or hail has fallen from 8 p. m. to 8 p. m.

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890.

Appropriate headings show the nature of the data contained in the columns immediately underneath.

ABILENE, TEX.

[Lat., 32° 14′ N.; long., 99° 45′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a. m.	Dew point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	28.32	.79	43.1	53.1	49.8	83	17	59.9	39.6	37	37	81	59	.33	.16	5.8
Feb	28.21	.80	43.7	54.3	51.4	85	12	62.2	40.7	37	35	81	52	1.81	.86	4.4
Mar	28.20	1.00	47.1	61.9	56.6	92	20	68.1	45.1	34	35	66	45	0.14	.06	5.5
Apr	28.23	.51	55.0	66.0	62.1	90	34	71.3	52.9	50	50	85	63	9.80	2.82	5.9
May	28.12	.50	64.0	77.2	72.0	95	47	82.3	61.7	59	57	84	52	2.69	2.26	3.0
June	28.18	.47	70.5	84.6	78.2	96	56	87.9	68.6	65	60	83	44	.65	.28	2.3
July	28.20	.28	74.5	89.8	82.8	99	66	93.1	72.6	65	50	73	37	2.10	1.29	2.4
Aug	28.22	.38	72.9	85.7	80.8	98	66	90.0	71.6	67	63	83	50	2.11	.58	4.0
Sept	28.24	.48	62.9	74.3	71.0	91	43	80.0	62.1	60	59	90	62	5.19	4.42	3.6
Oct	28.21	.61	55.9	67.2	64.8	85	40	75.3	54.3	50	52	82	60	.97	.38	2.8
Nov	28.35	.69	45.8	57.6	54.5	86	33	64.2	44.8	40	41	80	58	2.10	.97	3.2
Dec	28.34	.92	42.1	51.9	49.9	78	21	59.9	39.9	35	37	78	59	.61	.53	3.8
Means	28.24	.62	56.5	68.6	64.5	09	12	74.5	54.5	50	49	80	53	28.50	......	3.9

ALBANY, N. Y.

[Lat., 42° 39′ N.; long., 73° 45′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a. m.	Dew point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
Jan	30.11	1.19	28.8	31.8	30.6	61	6	38.1	23.1	23	25	80	77	2.28	.62	6.9
Feb	30.54	1.35	28.5	32.3	31.0	60	4	38.6	23.5	23	26	80	80	2.52	.96	7.2
Mar	29.95	1.06	28.3	32.2	31.0	67	− 4	38.5	23.6	24	26	83	79	3.72	1.02	6.6
Apr	30.01	1.21	43.0	49.5	47.3	79	25	58.2	36.4	35	38	75	67	1.64	.51	5.4
May	29.87	.76	55.2	58.8	57.1	78	34	66.8	47.4	48	50	78	73	5.19	1.02	6.7
June	29.88	.53	66.2	69.4	68.5	89	46	78.9	58.1	56	58	72	70	2.72	1.72	5.1
July	29.93	.63	67.8	72.2	71.4	98	48	81.8	61.1	59	60	74	66	2.37	.73	5.0
Aug	29.92	.74	66.1	69.7	70.6	91	50	79.1	62.0	58	59	76	71	5.66	1.62	5.4
Sept	30.05	.58	57.7	62.2	62.0	82	36	69.9	54.1	52	56	83	80	8.91	3.27	4.9
Oct	29.83	1.03	47.1	50.5	50.6	76	34	57.2	41.1	42	44	83	78	5.76	1.65	7.1
Nov	29.96	.86	35.5	38.9	38.4	59	14	45.4	31.4	30	32	81	77	1.18	.84	5.8
Dec	29.90	1.22	18.4	21.6	19.8	46	− 2	26.9	12.8	13	15	78	78	2.94	1.38	6.0
Means	29.96	.93	45.2	49.4	48.2	98	− 4	56.6	39.8	39	41	79	75	44.89	......	6.0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890.

References: Large H represents the height of the barometer above sea level; T and small h the respective heights of thermometers and rain gauge above ground. † And calm. Rainy days are those having .01 of an inch or more of precipitation.

ABILENE, TEX.

[H=1,748. T=64. h=53.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	12.5	48	SW.	S.	14	4	0	7	19	7	3	6	2	8	11	12	5	0	7	0	1	0
Feb	14.5	36	N.	S.	10	3	1	1	26	5	3	7	0	10	13	5	5	0	6	0	2	0
Mar	13.5	48	NW.	S.	9	6	1	3	20	7	8	7	1	11	8	12	5	0	3	2	1	0
Apr	12.8	48	N	S.	12	1	0	13	17	7	3	6	1	9	7	14	13	0	0	0	8	0
May	12.4	38	E.	S.	6	2	5	12	26	3	2	5	1	19	10	2	6	0	0	2	6	0
June	11.1	36	W.	S.	1	4	2	5	47	0	0	1	0	22	6	2	4	0	0	11	1	0
July	10.2	32	NW.	S.	4	1	1	0	35	11	1	0	0	23	5	3	6	0	0	28	3	0
Aug	9.3	32	SE.	S.	4	5	0	17	20	2	0	2	3	16	8	7	10	0	0	19	4	0
Sept	9.0	34	N.	S.	18	8	0	6	23	3	0	1	1	15	10	5	7	0	0	1	4	0
Oct	10.9	38	S.	S.	11	6	0	4	25	8	3	1	4	21	5	5	5	0	0	0	1	0
Nov	8.6	35	S.	S.	17	1	0	7	18	5	2	8	2	18	7	5	5	0	0	0	2	0
Dec	9.8	60	W.	S.	14	1	1	5	27	5	1	6	2	14	2	5	3	0	5	0	0	0
Means	11.5	....	......	S.	120	42	11	80	312	63	26	50	17	186	102	77	74	0	21	63	33	0

ALBANY, N. Y.

[H=85. T=84.1. h=99.4.]

Jan	9.5	36	SE.	S.	0	2	3	8	16	0	10	14	0	5	8	18	17	8	25	0	0	0
Feb	9.5	48	SE.	NW.	9	3	0	12	12	1	5	14	0	3	8	17	17	7	22	0	1	0
Mar	8.9	37	SE.	NW.	6	5	0	7	9	3	7	24	1	5	10	16	18	8	23	0	0	0
Apr	8.9	36	NW.	S.	11	3	0	9	12	4	11	10	0	3	20	7	10	0	8	0	0	0
May	8.5	33	SE.	SE.	8	3	1	15	11	3	4	15	2	3	14	14	15	0	0	0	1	0
June	7.6	28	N.	S.	8	4	0	12	19	0	3	14	0	7	17	6	13	0	0	0	3	0
July	7.4	26	S.	SE.	3	4	0	18	13	5	3	16	0	6	19	6	13	0	0	3	1	0
Aug	7.7	30	SE.	SE.	4	4	0	19	8	1	7	19	0	3	19	9	14	0	0	2	1	0
Sept	6.3	24	W.	NW.	6	3	0	7	18	3	2	20	1	10	10	10	16	0	0	0	0	0
Oct	6.7	26	SE.	NW.	5	5	1	10	8	2	5	26	0	6	6	19	17	0	0	0	0	0
Nov	7.5	34	W.	NW.	3	1	2	7	16	1	8	22	0	5	14	11	11	2	14	0	0	0
Dec	8.0	30	NW.	NW.	16	5	0	3	13	0	7	18	0	3	17	11	14	21	30	0	0	0
Means	8.0	....	......	NW.	88	42	7	127	155	23	72	212	4	59	162	144	175	46	122	5	7	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

ALPENA, MICH.

[Lat., 45° 5′ N.; long., 83° 30′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a.m.	Temperature. 8 p.m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a.m.	Dew-point. 8 p.m.	Relative humidity. 8 a.m.	Relative humidity. 8 p.m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.40	1.55	24.1	24.5	24.6	51	2	30.8	18.4	22	21	90	88	3.77	.82	8.2
Feb	29.34	1.31	23.0	21.9	24.0	49	6	30.6	17.4	20	21	88	87	2.23	.86	8.2
Mar	29.35	1.10	17.6	21.7	22.2	41	—13	29.3	15.2	14	20	86	84	2.07	.62	6.1
Apr	29.43	1.15	36.2	39.8	38.8	75	13	46.8	30.7	29	30	77	69	4.20	.78	5.7
May	29.24	.82	43.4	48.0	45.5	78	26	52.7	38.3	37	26	79	65	3.74	1.64	7.7
June	29.30	.65	62.4	61.8	63.4	89	38	71.3	55.4	55	55	79	74	1.83	.39	6.0
July	29.31	.66	63.8	67.6	65.6	88	44	73.8	57.5	57	58	79	73	2.54	.82	6.4
Aug	29.37	.61	59.5	63.0	60.9	81	40	68.1	53.7	54	54	82	73	3.11	.72	6.5
Sept	29.44	.84	52.0	57.3	55.9	89	32	63.5	48.3	47	50	84	77	.97	.24	6.2
Oct	29.25	.89	43.3	47.2	46.1	68	28	50.7	41.5	40	43	88	85	3.03	.52	8.0
Nov	29.32	.87	32.6	36.3	35.4	57	22	39.9	30.9	28	30	86	81	2.18	.84	7.2
Dec	29.35	1.20	21.9	25.2	24.0	47	1	28.9	19.0	19	21	88	85	1.68	.52	8.2
Means	29.34	.97	40.0	43.6	42.2	89	—13	48.9	35.5	35	37	84	78	31.35	......	7.0

ASTORIA, OREG.

[Lat., 46° 57′ N.; long., 124° W.]

Jan	......	......	......	......	35.4	50	21	39.8	30.9	......	......	......	......	12.64	2.40	......
Feb	......	......	......	......	39.8	53	16	45.2	34.5	......	......	......	......	11.48	3.24	......
Mar	......	......	......	......	44.4	59	32	50.4	38.4	......	......	......	......	7.56	.90	......
Apr	......	......	......	......	48.3	68	32	55.7	40.9	......	......	......	......	2.62	.56	......
May	......	......	......	......	57.1	76	40	64.9	49.3	......	......	......	......	1.14	.60	......
June	......	......	......	......	57.9	76	45	65.0	50.7	......	......	......	......	3.23	.60	......
July	......	......	......	......	60.3	76	50	67.1	53.5	......	......	......	......	1.84	.91	......
Aug	......	......	......	......	61.4	83	50	68.1	54.7	......	......	......	......	1.56	1.08	......
Sept	......	......	......	......	58.0	76	42	66.0	50.0	......	......	......	......	0.13	.08	......
Oct	......	......	......	......	52.0	64	38	58.6	45.5	......	......	......	......	5.61	.83	......
Nov	......	......	......	......	49.1	64	35	54.8	43.4	......	......	......	......	1.87	.59	......
Dec	......	......	......	......	45.2	60	34	51.7	40.6	......	......	......	......	8.81	2.12	......
Means	......	......	......	......	50.8	83	16	57.3	44.4	......	......	......	......	58.49	......	......

ATLANTA, GA.

[Lat., 33° 45′ N.; long., 84° 23′ W.]

Jan	29.10	.52	45.7	52.7	51.0	75	27	59.0	42.9	42	44	86	76	2.95	1.08	6.0
Feb	28.94	.52	49.5	56.2	51.8	76	28	63.3	46.3	45	45	84	69	3.36	.98	5.8
Mar	28.92	.66	43.6	50.9	49.6	78	17	59.0	40.2	36	39	76	65	3.13	1.20	5.0
Apr	28.96	.61	56.0	64.3	62.2	83	42	71.4	53.0	47	43	74	59	2.04	.58	5.3
May	28.82	.55	64.0	70.3	69.0	89	40	78.8	59.1	54	54	72	59	6.32	3.90	4.8
June	28.90	.41	73.5	80.0	78.8	98	62	88.9	68.6	66	66	77	62	1.12	.43	4.2
July	28.89	.52	73.0	78.6	78.2	95	61	87.3	69.0	66	66	79	68	5.37	3.44	0.3
Aug	28.92	.36	70.6	75.8	75.2	90	59	83.7	66.7	64	65	81	71	3.99	1.25	5.0
Sept	28.90	.30	66.7	71.0	71.6	91	52	79.1	64.1	64	63	90	78	5.36	2.07	6.8
Oct	28.85	.62	51.6	60.5	59.6	85	32	67.5	51.8	48	50	80	70	4.89	2.01	4.1
Nov	28.97	.46	49.4	59.2	57.6	82	30	68.2	47.1	41	42	74	57	.18	.13	1.8
Dec	28.96	.57	39.6	47.6	45.4	71	26	51.0	36.9	34	36	82	67	3.89	1.86	5.6
Means	28.93	.51	57.2	63.9	62.8	98	17	71.7	53.8	51	52	80	67	42.60	......	5.1

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

ALPENA, MICH.

[H=609. T=63. h=54.4.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	10.4	42	W.	W.	6	0	9	4	11	8	19	5	0	1	10	20	20	17	30	0	0	0
Feb	12.2	44	W.	W.	3	3	6	8	8	6	14	8	0	0	10	18	18	16	28	0	0	0
Mar	11.1	36	E.	NW.	1	2	5	7	2	7	16	20	2	6	13	12	14	17	28	0	0	0
Apr	9.1	36	NW.	SE.	9	7	4	12	5	7	6	10	0	9	12	9	13	0	17	0	1	0
May	9.7	38	W.	NW.	10	5	7	12	3	6	7	12	0	2	9	20	21	0	8	0	1	0
June	8.0	30	W.	SE.	0	3	9	19	5	3	5	12	4	9	9	12	13	0	0	0	2	0
July	8.9	32	SW.	W.	4	1	1	11	9	8	12	12	4	5	17	9	13	0	0	0	5	0
Aug	9.5	36	SE.	W.	3	2	1	14	11	2	14	14	1	3	15	13	14	0	0	0	5	0
Sept	8.2	30	S.	W.	3	2	5	10	12	4	13	10	1	7	12	11	12	0	1	0	1	0
Oct	8.5	36	SE.	W.	7	2	7	9	2	6	16	12	1	2	8	21	18	0	4	0	1	1
Nov	10.2	34	W.	W.	2	1	4	1	9	7	24	12	0	5	10	15	9	2	14	0	0	1
Dec	10.5	45	W.	W.	8	3	2	3	11	8	16	11	0	1	7	23	17	19	30	0	0	0
Means	9.7	....	......	W.	56	31	60	110	88	72	162	138	13	50	132	183	182	71	100	0	16	2

ASTORIA, OREG.

[H=38. T=39. h=55.8.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan				E.										6	3	22	24	3	15	0	0	0
Feb				SW.										7	6	15	17	1	8	0	0	0
Mar				SW.										2	8	21	23	0	0	0	0	0
Apr				W.										11	13	6	11	0	0	0	0	0
May				W.										10	13	8	8	0	0	0	0	0
June				SW.										9	8	13	16	0	0	0	0	0
July				W.										14	7	10	11	0	0	0	0	0
Aug				W.										12	9	10	6	0	0	0	0	0
Sept				W.										15	7	8	5	0	0	0	0	0
Oct				W.										8	5	18	17	0	0	0	0	0
Nov				E.										13	4	13	13	0	0	0	0	0
Dec				E.										4	5	22	21	0	0	0	0	0
Means				W.										111	97	157	172	4	23	0	0	0

ATLANTA, GA.

[H=1,130. T=98. h=95.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	9.8	35	NW.	E.	1	1	22	2	6	12	5	13	0	5	16	10	11	0	5	0	0	0
Feb	9.7	34	E.	SW.	1	4	10	7	3	16	4	11	0	6	12	10	11	0	3	0	3	0
Mar	9.9	39	W.	NW.	4	2	8	9	4	6	7	21	1	10	11	10	12	1	10	0	3	0
Apr	8.9	40	NW.	NW.	2	1	12	9	6	6	7	15	2	8	13	9	11	0	0	0	2	0
May	7.3	32	NW.	NW.	6	0	7	8	11	9	4	16	1	6	23	2	12	0	0	0	6	0
June	6.8	25	E.	NW.	8	1	9	5	3	8	11	13	2	11	18	1	8	0	0	12	1	0
July	6.7	24	SE.	E.	6	1	15	12	7	3	5	9	4	7	12	12	10	0	0	13	0	0
Aug	6.0	24	W.	E.	2	1	20	0	3	8	4	18	6	9	13	9	16	0	0	2	3	0
Sept	6.9	21	E.	E.	3	4	28	9	2	2	1	6	5	1	19	10	19	0	0	1	2	0
Oct	9.0	36	E.	NW.	9	0	12	6	0	4	7	17	7	15	9	7	13	0	0	0	0	0
Nov	6.5	32	NW.	NW.	7	1	7	8	3	2	3	20	9	23	5	2	4	0	3	0	0	0
Dec	10.0	36	NW.	NW.	7	3	6	11	4	3	4	23	1	11	5	15	10	0	8	0	2	0
Means	8.1			NW.	56	19	156	86	52	79	62	182	38	112	156	97	137	1	29	28	22	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

ATLANTIC CITY, N. J.

[Lat., 39° 22′ N.; long., 74° 25′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a. m.	Dew point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	30.19	1.08	40.5	43.2	42.1	64	18	48.8	35.4	34	36	80	76	1.27	.62	5.7
Feb	30.06	.95	39.9	41.8	41.2	71	20	47.4	35.1	34	35	81	79	2,43	.65	5.9
Mar	30.00	1.06	36.5	39.0	38.2	63	10	44.5	31.9	30	31	79	76	5.20	.82	5.8
Apr	80.07	1.16	47.1	48.9	47.7	80	29	54.2	41.2	38	41	73	77	3.86	2.10	3.8
May	29.94	.64	56.7	57.0	57.0	76	44	61.6	52.4	52	52	84	85	5.81	2.05	5.0
June	29.96	.56	68.7	68.9	68.9	90	54	75.0	62.8	61	62	77	81	2.99	1.16	4.0
July	30.00	.50	71.2	71.1	70.8	89	52	76.0	65.5	64	64	80	80	5.46	1.38	4.1
Aug	29.99	.55	70.7	70.7	71.0	90	48	75.9	66.0	65	66	82	86	7.51	2.76	4.3
Sept	30.09	.50	65.4	65.9	65.5	78	48	70.5	60.5	60	62	84	86	5.01	1.43	5.3
Oct	29.87	.88	54.5	55.5	55.6	74	35	61.1	50.0	48	49	79	80	4.05	1.02	5.5
Nov	30.05	.75	44.0	46.3	46.0	70	18	51.8	40.2	39	39	82	76	.38	.20	3.3
Dec	30.03	1.19	32.4	35.3	33.6	54	17	39.8	27.3	27	29	80	80	3.33	1.36	4.4
Means	30.02	.82	52.3	53.6	53.1	90	10	58.9	47.4	46	47	80	80	47.30	......	4.8

AUGUSTA, GA.

[Lat., 33° 28′ N.; long., 81° 54′ W.]

Jan	30.15	.60	48.4	56.0	55.6	80	20	65.1	46.2	44	50	87	81	.80	.53	5.5
Feb	29.98	.58	50.6	59.4	58.2	84	36	68.1	48.4	46	48	85	68	1.88	.50	5.2
Mar	29.96	.74	48.3	56.6	55.2	84	23	66.3	44.1	40	39	76	56	3.05	.97	4.8
Apr	29.99	.74	59.3	66.4	65.0	89	39	76.0	54.1	51	51	75	60	2.33	1.47	4.4
May	29.83	.57	68.6	73.4	72.9	92	45	83.9	61.9	60	59	76	62	5.28	1.91	4.5
June	29.88	.48	79.2	81.7	83.2	102	66	94.8	71.5	70	68	74	64	3.70	1.64	4.1
July	29.88	.57	76.5	79.7	81.0	99	64	90.3	71.6	70	70	81	74	9.16	2.55	5.9
Aug	29.92	.40	74.7	78.2	79.3	96	59	89.5	69.1	68	68	80	71	2.26	1.51	4.2
Sept	29.92	.30	70.4	72.7	75.1	94	56	83.3	66.9	67	68	88	86	8.91	2.20	6.8
Oct	29.85	.59	57.9	62.9	64.3	90	36	74.3	54.3	53	56	86	77	3.96	2.75	3.5
Nov	29.99	.48	49.1	58.0	58.8	80	32	70.9	46.7	46	50	89	75	.47	.23	3.2
Dec	29.99	.76	40.1	50.1	48.6	71	28	59.2	38.1	35	38	84	66	1.18	.43	4.0
Means	29.94	.57	60.3	66.3	66.4	102	23	76.8	56.1	54	55	82	70	42.98	......	4.7

BAKER CITY, OREGON.

[Lat., 44° 51′ N.; long., 117° 50′ W.]

Jan	26.39	1.02	10.0	18.9	16.1	45	—14	23.9	8.3	4	9	78	66	1.55	.56	7.3
Feb	26.38	1.32	22.0	30.9	27.7	51	—11	34.6	20.8	17	23	81	72	2.08	.52	7.0
Mar	26.44	1.22	30.5	41.6	37.6	59	10	46.0	20.1	24	28	78	61	1.90	.40	7.7
Apr.	26.48	.76	36.7	56.4	47.2	81	18	60.3	34.2	26	32	67	43	.36	.16	4.4
May	26.44	.70	43.9	64.2	54.6	85	27	68.5	40.8	30	41	60	46	1.33	.52	4.2
June	26.48	.63	45.9	60.4	56.2	92	32	69.6	42.8	33	44	62	49	2.07	.44	4.8
July	26.47	.40	52.8	70.9	66.4	101	37	84.6	48.2	33	41	49	26	.01	.01	1.4
Aug	26.49	.47	49.0	77.5	64.5	93	36	83.0	46.0	34	44	58	33	.12	.06	1.9
Sept	26.51	.41	42.1	71.1	58.6	89	24	78.0	39.3	26	41	55	36	1.22	1.22	1.5
Oct.	26.53	.52	36.2	50.4	45.5	70	21	59.6	31.4	28	33	73	52	1.02	.62	3.7
Nov	26.67	.69	28.4	43.2	37.7	65	15	52.7	22.7	17	23	64	48	T	T	2.8
Dec	26.55	1.07	27.2	34.9	32.3	52	15	41.1	23.5	18	22	70	62	.75	.24	5.8
Means	26.49	.77	35.4	52.9	45.4	101	—14	58.5	32.3	24	32	66	50	12.50	......	4.4

Annual Meteorological Summary for the Year Ending December 31, 1890—Continued.

ATLANTIC CITY, N. J.

[H=53. T=68. h=57.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	13.1	46	NW.	SW.	8	4	1	3	7	18	7	14	0	7	12	12	10	1	11	0	0	0
Feb	13.1	48	S.	SW.	9	4	5	4	5	14	7	8	0	6	11	11	12	1	9	0	1	0
Mar	14.5	42	W.	NW.	9	3	2	2	6	14	7	19	0	8	11	12	13	4	14	0	0	0
Apr	11.1	42	NW.	SW.	11	2	6	7	9	14	3	8	0	17	7	6	11	0	3	0	2	0
May	11.7	36	NW.	SW.	5	9	8	6	11	18	0	5	0	13	5	13	14	0	0	0	2	0
June	9.0	32	W.	S.	7	3	7	8	11	10	6	0	2	11	17	2	9	0	0	0	4	0
July	10.4	34	NW.	SW.	10	2	5	8	16	19	1	0	1	14	10	7	10	0	0	0	3	0
Aug	10.2	36	SW.	SW.	4	3	8	6	7	17	4	13	0	14	12	5	11	0	0	0	1	0
Sept	10.6	35	NE.	SW.	7	9	8	4	6	11	7	8	0	8	13	9	12	0	0	0	1	0
Oct	12.9	52	NW.	NW.	7	3	7	6	2	8	10	19	0	10	7	14	15	0	0	0	0	0
Nov	9.8	36	NW.	SW.	10	6	1	1	4	18	12	7	1	17	7	6	6	0	5	0	0	0
Dec	14.1	48	NE.	NW.	10	3	3	5	3	12	8	18	0	14	10	7	10	4	24	0	0	0
Means	11.7	....	......	SW.	97	51	61	60	87	173	72	125	4	139	122	104	133	10	60	0	14	0

AUGUSTA, GA.

[H=183. T=45½. h=40½.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan	4.1	26	N.	NE.	4	13	1	2	6	9	11	8	8	10	12	9	10	0	2	0	0	0
Feb	4.6	22	SW.	S.	5	8	1	4	11	8	6	5	8	9	12	7	7	0	0	0	0	0
Mar	5.2	29	SW.	W.	3	5	5	7	8	11	14	6	3	10	13	8	10	0	7	0	0	0
Apr	4.1	25	W.	NE.	3	11	3	7	9	7	6	4	10	14	8	8	8	0	0	0	1	0
May	3.4	30	S.	S.	3	5	4	11	13	6	6	5	9	15	9	7	11	0	0	1	4	0
June	3.1	45	N.	SE.	2	7	4	12	6	9	11	2	7	12	16	2	9	0	0	24	11	0
July	2.9	24	SE.	E.	1	8	14	9	14	7	3	2	4	6	14	11	14	0	0	16	6	0
Aug	2.7	15	SW.	SE.	2	10	8	15	13	4	2	4	9	11	16	4	6	0	0	14	5	0
Sept	3.0	15	NE.	NE.	2	22	10	8	6	1	2	2	7	4	10	16	18	0	0	5	8	0
Oct	3.0	18	SW.	W.	2	9	4	6	1	7	15	6	18	19	5	7	9	0	0	0	0	0
Nov	1.9	13	W.	W.	1	4	4	5	6	2	10	5	23	19	6	5	5	0	1	0	0	0
Dec	3.5	24	W.	W.	5	5	3	4	2	6	16	10	11	14	9	8	6	0	5	0	1	0
Means	3.3	....	......	NE.	33	107	56	84	95	77	102	59	117	143	130	92	113	0	15	60	36	0

BAKER CITY, OREGON.

[H=3420. T=48.8. h=38.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan	7.5	30	SE.	SE.	0	2	2	46	0	3	0	4	5	4	9	18	15	22	30	0	0	0
Feb	7.2	36	SE.	SE.	0	0	0	30	0	1	0	18	7	6	4	18	14	9	24	0	0	0
Mar	6.1	32	SW.	SE.	0	0	1	30	1	11	0	14	5	5	4	22	15	0	21	0	0	0
Apr	6.6	25	NW.	SE.	2	0	0	29	0	7	0	21	1	12	10	8	7	0	9	0	0	0
May	6.0	25	NW.	NW.	0	1	0	25	0	0	0	32	4	14	10	7	7	0	2	0	2	0
June	5.6	30	SE.	NW.	0	2	0	17	2	1	3	33	2	11	9	10	13	0	1	2	1	0
July	5.7	30	SE.	SE.	3	2	1	25	0	4	1	23	3	26	4	1	1	0	0	10	0	0
Aug	6.0	24	NW.	NW.	3	3	0	19	14	3	0	23	0	23	5	3	2	0	0	4	0	0
Sept	6.1	26	N.	S.	5	3	0	13	17	5	0	16	1	24	4	2	1	0	2	0	1	0
Oct	5.8	28	NW	SE.	3	7	1	19	10	3	1	14	4	14	11	6	7	0	18	0	0	0
Nov	5.9	24	SW.	SE.	0	0	0	24	10	6	1	14	5	18	8	4	0	0	29	0	0	0
Dec	5.7	24	SE.	SE.	0	0	0	23	18	11	1	4	5	10	6	15	8	0'	30	0	0	0
Means	6.2	....	......	SE.	16	17	5	300	72	55	7	216	42	167	84	114	90	31	160	16	4	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

BALTIMORE, MD.

[Lat., 39° 18′ N.; long., 99° 45′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a. m.	Dew point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°			In.	In.	
Jan	30.16	.99	41.3	44.9	44.0	73	20	51.4	36.6	31	34	73	67	1.80	.49	6.3
Feb	30.03	.93	39.4	44.2	43.4	74	23	50.3	36.4	32	34	77	69	4.80	1.46	6.1
Mar	29.98	1.11	37.6	41.8	41.6	77	12	49.5	33.7	27	29	68	64	4.07	.88	5.6
Apr	30.04	1.12	50.0	56.2	54.0	83	31	63.4	44.5	28	41	66	59	3.94	.92	3.7
May	29.89	.67	61.2	64.9	64.0	87	43	72.4	55.5	51	52	71	66	5.98	1.58	5.9
June	29.92	.62	72.3	76.8	75.0	93	55	84.0	65.9	60	63	65	63	2.42	.93	4.1
July	29.95	.55	73.1	77.9	75.4	98	55	83.7	67.2	62	62	68	60	3.61	1.15	4.7
Aug	29.95	.50	71.4	74.1	74.1	95	51	81.6	66.6	62	64	73	72	6.44	1.96	5.1
Sept	30.04	.44	65.0	68.4	68.4	87	46	75.9	60.9	58	60	78	76	4.76	1.09	5.5
Oct	29.85	.89	54.0	56.9	57.0	78	36	63.1	50.8	45	47	72	71	5.73	3.04	5.8
Nov	30.01	.68	43.4	48.6	48.2	73	26	55.8	40.6	33	37	68	64	0.74	.30	4.0
Dec	30.00	1.16	31.7	35.6	34.6	59	18	40.7	28.4	21	24	65	66	2.67	1.12	5.4
Means	29.98	.80	53.3	57.5	56.6	98	12	64.3	48.9	43	46	70	66	46.96	......	5.2

BISMARCK, N. DAK.

[Lat., 46° 47′ N.; long., 100° 38′ W.]

Jan	28.29	1.22	−6.0	.5	−2.1	39	−35	7.0	−11.2	−12	−5	76	78	.80	.59	4.0
Feb	28.26	1.23	−0.8	6.8	3.6	46	−34	14.6	−7.4	−5	2	81	79	.27	.09	4.7
Mar	28.22	1.13	15.2	24.9	20.6	52	−24	28.6	12.6	10	17	80	74	.49	.35	4.1
Apr	28.22	1.02	37.3	53.8	46.8	82	19	59.6	33.9	32	42	82	68	.68	.47	3.8
May	28.11	.96	44.3	58.7	51.3	83	27	63.7	38.9	40	51	85	78	.57	.18	4.6
June	28.10	.62	60.8	72.8	66.9	91	46	78.0	55.8	55	66	83	79	8.40	1.96	3.7
July	28.17	.69	63.7	79.9	71.0	98	44	84.3	57.7	55	68	76	67	1.14	.68	3.1
Aug	28.18	.72	55.6	76.3	66.8	103	40	81.9	51.7	51	58	85	54	.69	.34	2.9
Sept	28.22	.92	45.2	62.2	56.4	88	26	70.5	42.2	42	51	89	69	.98	.43	3.9
Oct	28.11	.78	39.1	48.2	46.2	84	22	56.2	36.1	36	42	91	82	1.37	.56	4.3
Nov	28.26	1.09	29.1	38.0	37.0	70	8	49.1	24.9	27	33	94	84	.14	.10	3.5
Dec	28.22	.87	19.9	26.3	24.9	64	−7	36.6	13.2	18	23	92	88	.22	.08	3.8
Means	28.20	.94	33.6	45.7	40.8	103	−35	52.5	29.0	29	37	84	75	15.75	......	3.9

BLOCK ISLAND, R. I.

[Lat., 41° 10′ N.; long., 71° 36′ W.]

Jan	30.17	1.43	36.8	39.0	37.0	57	14	43.5	30.6	31	33	82	82	2.33	.87	6.5
Feb	30.09	1.16	36.4	37.6	37.2	58	14	43.2	31.1	31	32	82	82	1.50	.47	5.4
Mar	29.99	1.15	34.4	36.2	35.4	53	11	40.6	30.2	29	30	82	81	5.16	.98	5.9
Apr	30.07	1.03	43.3	44.8	44.6	63	28	49.9	39.2	36	39	76	80	3.37	1.27	3.6
May	29.97	.67	52.4	52.4	52.2	66	42	56.6	47.8	48	50	87	92	3.83	1.36	6.1
June	29.97	.56	60.8	61.3	61.6	80	50	67.4	55.8	56	58	86	88	1.35	.46	4.6
July	30.02	.55	67.4	66.6	67.6	85	54	73.1	62.0	63	63	87	88	1.39	.74	4.9
Aug	30.00	.66	67.0	67.5	67.9	79	53	72.6	63.2	63	63	87	87	2.09	.82	5.0
Sept	30.12	.66	63.3	63.8	63.7	74	48	68.2	59.2	59	60	87	87	2.69	1.19	4.9
Oct	29.86	1.09	52.5	53.7	53.4	70	41	57.3	49.5	46	47	81	79	4.57	1.16	6.0
Nov	30.02	.87	44.4	44.7	44.0	60	19	49.2	38.7	37	37	77	77	.66	.26	4.0
Dec	30.01	1.14	30.8	32.9	31.4	54	10	38.4	24.3	22	25	69	73	2.57	1.16	4.6
Means	30.02	.91	49.1	50.0	49.7	85	10	55.0	44.3	43	45	82	83	31.51	......	5.1

Annual Meteorological Summary for the Year Ending December 31, 1890—Continued.

BALTIMORE, MD.

[H=76. T=86. h=78½.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days. Cloudiness.	Partly cloudy.	Cloudy.	Rainy.	Max. above 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	5.6	28	SW.	SW.	5	10	3	2	9	17	2	14	0	7	11	13	13	1	9	0	0	0
Feb	5.5	24	NW.	NE.	0	14	8	5	6	7	3	13	0	9	7	12	13	0	8	0	1	0
Mar	6.7	24	NW.	NW.	5	13	1	6	2	13	1	21	0	8	13	10	16	4	13	0	0	0
Apr	5.6	30	SW.	NE.	7	12	4	7	9	8	2	9	1	16	8	6	13	0	2	0	2	0
May	5.3	24	NW.	S.	6	10	7	8	14	5	0	11	1	7	13	11	18	0	0	0	3	0
June	4.6	24	SW.	S.	7	5	7	4	13	10	2	12	0	12	14	4	6	0	0	4	1	0
July	4.7	18	NE.	S.	10	6	2	7	16	12	4	4	1	13	10	8	10	0	0	7	3	0
Aug	4.9	26	N.	S.	11	10	5	2	13	7	4	9	1	9	15	7	15	0	0	2	5	0
Sept	4.7	18	NE.	NE.	9	10	5	5	8	9	1	8	5	8	14	8	12	0	0	0	1	0
Oct	5.3	28	N.	NW.	10	11	8	0	5	3	9	15	1	10	9	12	16	0	0	0	0	0
Nov	4.6	24	NW.	NW.	8	10	1	3	5	10	4	12	7	15	9	6	9	0	3	0	0	0
Dec	6.0	39	NE.	NW.	7	12	1	0	3	15	3	17	4	13	8	10	14	2	20	0	0	0
Means	5.3	....	......	NW.	85	124	52	49	103	116	35	145	21	127	131	107	155	7	55	13	16	...

BISMARCK, N. DAK.

[H=1,681. T=16. h=2.]

Jan	7.1	36	W.	NW.	2	8	6	4	1	1	9	23	5	20	6	5	4	25	31	0	0	0
Feb	10.2	64	NW.	NW.	4	6	6	1	2	7	3	22	5	11	9	8	6	21	28	0	0	0
Mar	11.5	54	NW.	NW.	5	6	5	5	6	3	0	21	11	17	8	6	7	17	31	0	0	0
Apr	11.4	50	NW.	N.	14	6	2	7	13	7	2	9	0	19	4	7	7	0	13	0	0	0
May	15.5	60	NW.	NW.	11	10	10	2	4	1	4	20	0	14	11	6	9	0	7	0	1	0
June	11.5	52	SE.	E.	8	6	13	6	6	4	8	9	0	20	7	3	18	0	0	2	2	0
July	10.1	48	E.	N.	16	8	8	9	6	2	5	8	0	25	4	2	7	0	0	8	2	0
Aug	10.8	46	NW.	N.	11	5	6	8	5	2	9	13	0	23	4	1	5	0	0	5	0	0
Sept	10.4	42	NW.	NW.	5	10	5	2	12	0	4	22	0	22	2	6	10	0	3	0	1	0
Oct	12.4	52	W.	NW.	8	6	2	1	6	6	5	28	0	21	3	7	11	0	7	0	0	0
Nov	9.0	48	N.	NW.	8	3	2	0	6	7	8	25	1	22	6	2	5	3	26	0	0	1
Dec	9.4	58	NW.	NW.	1	10	2	2	9	7	11	20	0	21	5	5	5	11	30	0	0	0
Means	10.8	....	......	NW.	93	81	67	17	76	47	68	223	22	238	69	58	93	77	176	15	6	1

BLOCK ISLAND, R. I.

[H=27. T=38.75. h=32.83.]

Jan	20.0	66	NW.	NW.	5	7	2	0	3	15	9	20	1	5	11	15	16	3	16	0	0	0
Feb	19.4	54	NW.	NW.	4	9	3	5	5	10	5	14	1	10	7	11	14	3	13	0	0	0
Mar	18.9	60	NE.	NW.	8	6	4	2	2	12	12	16	0	7	11	13	18	3	17	0	1	0
Apr	15.8	48	NE.	SW.	8	12	3	3	3	18	7	6	0	17	8	5	9	0	3	0	1	0
May	14.7	43	NE.	SW.	4	11	3	4	10	21	3	5	1	10	8	13	13	0	0	0	0	0
June	12.9	37	NE.	SW.	3	13	3	5	3	21	5	7	0	13	80	7	8	0	0	0	1	0
July	12.6	38	W.	SW.	4	4	2	7	4	28	5	8	0	12	10	9	6	0	0	0	1	0
Aug	13.5	45	SW.	SW.	1	10	4	3	5	18	6	14	1	10	13	8	11	0	0	0	1	0
Sept	13.9	40	NE.	SW.	5	11	4	4	3	18	10	5	0	11	9	10	13	0	0	0	1	0
Oct	18.7	78	NE.	NW.	6	12	88	3	3	5	5	15	2	7	11	13	87	0	0	0	1	1
Nov	16.3	42	NW.	SW.	9	2	1	2	1	19	9	17	0	18	8	4	5	1	7	0	0	2
Dec	22.7	82	NE.	NW.	5	10	6	1	1	4	10	25	0	14	8	9	11	8	24	0	0	0
Means	16.6	....	......	SW.	62	107	46	39	43	189	86	152	6	134	114	117	141	18	80	0	7	8

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

BOISÉ CITY, IDAHO.

[Lat., 43° 37′ N.; long., 116° 12′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a. m.	Dew point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	*In.*	*In.*	°	°	°	°	°	°	°	°	°	%	%	*In.*	*In.*	
Jan	27.18	1.14	19.3	27.0	22.8	30.3	15.4	51	— 9	10	15	73	63	1.26	.38	6.9
Feb	27.15	1.27	30.5	38.2	34.2	41.1	27.3	55	— 6	23	22	76	56	3.12	.68	7.4
Mar	27.19	1.16	35.3	47.1	41.2	49.6	32.7	64	14	29	29	78	51	3.34	.86	6.7
Apr	27.18	.91	41.5	62.4	51.8	64.4	39.2	85	23	32	26	72	28	.48	.34	4.6
May	27.11	.68	49.7	70.6	60.2	73.2	47.2	89	38	39	35	67	31	1.64	.85	4.0
June	27.14	.62	51.9	73.5	62.6	75.9	49.4	96	38	39	34	62	26	.56	.27	4.5
July	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Aug	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Sept	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Oct	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Nov	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Dec	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Means	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

BOSTON, MASS.

[Lat., 42° 21′ N.; long., 71° 4′ W.]

Jan	30.03	1.51	30.7	33.8	32.4	66	8	41.0	23.8	23	25	75	71	2.00	.70	6.
Feb	29.96	1.34	32.2	32.7	33.2	65	5	41.2	25.3	20	23	77	72	2.29	.69	6.
Mar	29.85	1.14	32.7	35.4	31.9	68	4	42.2	27.6	25	25	74	69	5.88	1.19	5.
Apr	29.95	1.03	44.8	45.8	40.3	72	26	54.3	38.3	32	33	62	64	2.20	.85	4.
May	29.85	.72	50.1	56.0	57.0	80	39	65.2	48.9	47	48	73	75	4.48	1.02	5.
June	29.85	.59	62.6	64.5	64.2	87	50	72.1	56.3	52	53	70	70	2.21	.99	5.
July	29.89	.60	69.7	71.3	71.0	95	52	79.0	62.9	58	58	68	66	1.93	1.01	5.
Aug	29.88	.73	66.8	68.3	68.9	89	50	76.1	61.7	59	60	77	75	2.70	.68	5.
Sept	30.00	.72	60.8	62.9	62.9	83	39	69.6	50.2	54	56	80	78	5.04	1.62	5.
Oct	29.76	1.10	49.2	51.0	51.0	77	36	56.4	45.6	42	44	78	79	5.63	1.42	6.
Nov	29.88	.95	39.8	41.6	41.8	64	15	49.1	34.5	33	34	77	77	.97	.65	4.
Dec	29.88	1.23	23.8	26.8	26.0	56	0	34.2	17.8	17	19	76	74	3.72	1.34	5.
Means	29.90	.97	47.4	49.2	49.1	95	0	56.7	41.6	39	40	74	72	39.14	......	5.

BROWNSVILLE, TEX.

[Lat., 25° 53′ N.; long., 97° 26′ W.]

Jan	30.08	.77	64.4	69.0	69.3	82	37	76.3	62.1	62	64	92	81	.09	.43	5.
Feb	29.97	.73	63.0	68.2	68.6	83	38	76.5	60.6	61	61	92	79	1.23	.81	5.
Mar	29.97	1.04	63.0	69.7	69.6	83	31	77.9	61.2	58	61	84	75	.14	.11	5.
Apr	29.96	.54	71.4	73.2	74.4	88	53	81.0	67.7	68	67	89	82	5.48	3.46	6.
May	29.85	.46	75.6	78.4	78.4	94	64	85.5	71.3	72	71	88	78	3.33	1.73	4.
June	29.94	.32	78.4	81.2	81.0	97	69	88.3	73.8	75	73	88	77	2.32	2.20	3.
July	29.93	.29	79.4	83.4	83.5	94	69	91.7	75.3	76	74	88	73	3.97	2.84	3.
Aug	29.94	.32	77.7	83.5	83.1	94	72	91.8	74.4	75	74	90	74	1.51	.59	4.
Sept	29.93	.31	73.9	80.2	79.8	93	55	89.9	69.8	70	71	89	74	1.51	.48	4.
Oct	29.94	.59	69.9	75.7	76.0	92	52	85.0	66.9	66	67	87	76	3.67	2.71	5.
Nov	30.09	.51	59.9	67.0	67.2	88	44	76.3	58.1	58	59	86	76	1.32	.90	5.
Dec	30.12	.75	57.1	64.5	64.8	88	38	74.5	55.0	53	57	86	78	.38	.20	5.
Means	29.98	.55	69.5	74.5	74.6	97	31	82.9	66.4	66	67	88	77	25.55	......	4.

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

BOISÉ CITY, IDAHO.

[H=2,750. T=42.8. h=35 5.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudiness.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	5.6	28	SE.	SE.	6	3	4	25	4	1	6	7	6	2	14	15	11	17	28	0	0	0
Feb	5.9	28	SW.	SE.	4	5	5	17	5	1	11	4	4	3	8	17	12	4	19	0	0	0
Mar	5.2	24	SE.	SE.	7	3	10	18	4	3	7	8	2	3	17	11	14	1	16	0	0	0
Apr	4.9	32	E.	NW.	8	4	7	11	7	2	3	16	2	10	14	6	3	0	6	0	0	0
May	5.0	28	SE.	NW.	8	2	5	13	3	2	12	15	2	14	12	5	6	0	0	0	1	0
June	4.8	24	W.	W.	9	2	4	13	2	1	19	5	5	9	16	5	7	0	0	3	1	0
July																						
Aug																						
Sept																						
Oct.																						
Nov																						
Dec																						
Means																						

BOSTON, MASS.

[H=125. T=115.4. h=174.5.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudiness.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan.	12.9	44	NW.	W.	4	5	1	5	8	9	16	13	1	6	10	15	13	8	23	0	0	0
Feb	13.5	48	W.	W.	7	3	7	3	6	7	14	9	0	8	6	14	14	6	19	0	1	0
Mar	13.4	36	E.	NW.	9	4	0	0	6	12	15	16	0	10	8	13	17	6	20	0	1	0
Apr	12.3	40	NW.	NW.	5	7	5	4	2	13	9	15	0	13	10	7	12	0	5	0	0	0
May	11.6	42	S.	S.	7	7	2	8	14	15	5	4	0	9	11	11	15	0	0	0	1	0
June	10.8	30	NW.	NW.	5	8	8	1	2	13	10	13	0	8	13	9	8	0	0	0	3	0
July	10.2	35	W.	SW.	3	2	6	3	14	16	10	8	0	8	13	10	9	0	0	5	1	0
Aug	7.2	27	W.	SW.	2	7	4	12	5	12	13	7	0	7	16	8	12	0	0	0	3	0
Sept	10.1	34	SW.	SW.	4	9	7	2	6	10	13	9	0	10	7	13	12	0	0	0	0	0
Oct	11.7	54	NE.	NW.	14	5	7	3	3	11	6	13	0	7	8	16	16	0	0	0	0	0
Nov	11.5	41	W.	W.	2	0	0	2	3	19	18	16	0	10	11	9	6	2	10	0	0	0
Dec	15.0	54	NE.	NW.	3	3	0	0	0	9	18	29	0	10	9	12	10	12	28	0	0	0
Means	11.7			NW.	65	60	47	43	69	146	147	152	1	106	122	137	141	34	105	5	10	0

BROWNSVILLE, TEX.

[H=57. T=17. h=1.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudiness.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan.	10.0	37	S.	S.	6	4	7	12	23	0	2	4	4	14	8	9	7	0	0	0	1	0
Feb	12.2	37	S.	S.	4	4	9	8	24	0	1	6	0	3	21	4	5	0	0	0	0	0
Mar	13.0	44	S.	S.	4	7	8	12	25	0	3	2	1	11	10	10	3	0	1	0	0	0
Apr	11.0	44	S.	SE.	8	16	17	21	5	0	0	3	0	5	13	12	9	0	0	2	2	0
May	8.0	36	NW.	SE.	5	7	8	22	14	0	1	2	3	12	17	2	6	0	0	8	1	0
June	7.8	31	S.	SE.	3	1	4	30	15	1	0	1	5	19	8	3	4	0	0	24	3	0
July	7.3	28	S.	S.	1	1	10	20	21	0	0	1	8	19	8	4	6	0	0	27	0	0
Aug	6.2	24	S.	E.	1	5	23	19	6	2	0	0	6	10	19	2	7	0	0	18	2	0
Sept	5.8	23	NE.	E.	4	8	17	9	3	1	0	5	13	14	13	3	9	0	0	5	0	0
Oct	7.5	28	NE.	SE.	12	10	8	18	4	2	2	5	1	10	14	7	11	0	0	0	0	0
Nov	8.8	31	S.	N.	18	5	5	9	5	0	1	16	1	12	9	9	8	0	0	0	0	0
Dec	9.1	42	S.	S.	15	4	5	9	22	1	2	4	0	12	9	10	4	0				0
Means	8.8			SE.	81	62	121	189	167	7	12	49	42	141	149	75	79	0	1	84	11	0

Annual Meteorological Summary for the Year Ending December 31, 1890—Continued.

BUFFALO, N. Y.

[Lat., 42° 53′ N.; long., 78° 53′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a. m.	Dew point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.35	1.32	32.2	33.7	32.8	65	10	39.7	25.9	26	27	80	78	3.90	.73	7.3
Feb	29.27	1.02	30.2	31.5	31.4	60	13	38.4	24.4	24	26	80	81	3.66	1.04	7.6
Mar	29.26	1.21	28.1	29.8	29 1	54	8	31.3	23.9	23	22	81	74	2.40	.97	6.9
Apr	29.34	1.12	41.6	43.7	43.7	66	26	51.4	36.0	31	32	67	66	3.48	1.22	5.1
May	29.18	.68	51.0	52.8	52.0	79	34	59.6	44.3	42	44	74	74	6.13	1.52	5.7
June	29.24	.62	65.3	67.6	66.6	89	46	73.0	59.4	57	59	75	74	5.23	2.03	5.0
July	29.26	.63	68.2	71.0	69.6	89	49	77.0	62.1	57	58	69	66	1.27	.28	3.8
Aug	29.28	.46	64.2	66.8	65.8	86	48	72.7	59.0	56	56	75	70	3.52	1.04	5.2
Sept	29.37	.60	57.7	60.5	59.9	82	37	67.3	52.5	51	52	79	75	4.71	1.81	5.4
Oct	29.15	.98	48.1	49.7	50.0	75	34	55.3	44.7	42	44	80	81	6.12	1.00	7.6
Nov	20.25	.97	38.3	40.5	39.4	62	21	45.3	23.6	32	34	77	79	3.91	2.25	6.8
Dec	29.27	1.06	24.6	27.7	25.4	44	7	31.4	19.5	18	22	76	79	2.16	.49	7.1
Means	29.27	.89	45.8	47.9	47.1	89	7	53.8	40.4	38	40	76	75	46.55	......	6.1

CAIRO, ILL.

[Lat., 37° 0′ N.; long., 89° 10′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a. m.	Dew point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
Jan	29.84	1.01	41.4	46.1	44.6	73	17	51.6	37.5	37	38	86	75	6.32	1.50	7.6
Feb	29.70	.92	40.5	47.5	44.6	75	18	51.7	37.6	35	38	82	71	7.57	2.47	7.2
Mar	29.72	1.23	38.1	45.9	42.9	74	11	49.5	36.3	29	31	73	59	6.14	1.48	6.4
Apr	29.70	.73	54.9	61.4	59.2	80	36	66.0	52.4	46	48	74	64	3.76	1.33	6.1
May	29.58	.64	61.4	68.2	66.0	88	42	74.8	57.3	54	54	76	64	4.19	1.88	4.7
June	29.62	.40	75.0	80.8	79.4	96	62	87.8	70.9	69	70	81	70	1.45	1.27	5.6
July	29.64	.39	73.6	81.7	79.0	95	59	88.5	69.4	65	66	75	61	1.62	1.20	4.1
Aug	29.69	.42	69.7	76.5	75.0	91	56	83.3	66.8	65	65	84	69	5.16	1.46	6.9
Sept	29.70	.38	61.5	67.7	66.5	87	45	73.0	60.0	58	61	90	80	2.27	0.69	6.5
Oct	29.64	.66	52.5	58.7	58.0	84	32	65.5	50.5	48	49	87	72	3.04	0.86	5.4
Nov	29.76	.58	44.4	53.3	51.0	72	31	59.5	42.5	38	40	80	63	6.08	1.60	4.3
Dec	29.78	.81	34.8	41.9	40.0	63	20	46.7	33.3	28	31	80	68	2.91	1.19	5.0
Means	29.70	.68	54.0	60.8	58.8	96	11	66.5	51.2	48	49	81	68	50.51	......	5.7

CARSON CITY, NEV.

[Lat., 39° 10′ N.; long., 119° 46′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a. m.	Dew point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
Jan	......	......	15.8	25.8	21.0	50	—22	31.5	10.5	6	17	68	72	4.07	1.47	5.6
Feb*	25.27	1.03	28.3	37.4	33.0	59	— 3	42.6	23.5	16	19	62	55	2.19	.90	5.3
Mar	25.33	.83	33.7	46.2	40.6	62	12	51.1	30.0	20	21	58	41	.83	.28	5.1
Apr	25.33	.72	37.5	57.5	48.7	75	24	61.7	35.7	24	22	62	28	.17	.14	4.2
May	25.30	.55	45.7	66.4	57.0	85	32	71.5	42.5	34	29	65	28	.43	.23	3.4
June	25.33	.42	47.1	71.6	59.0	88	30	74.4	43.5	32	33	57	25	T.	T.	2.5
July†	......	.28	......	81.9	67.3	92	41	83.8	50.8	....	34	.....	18	.00	......	2.5
Aug	......	.26	......	79.1	66.2	91	41	82.5	49.8	....	36	.....	23	1.15	.75	3.4
Sept	......	.23	......	72.9	60.5	83	34	77.2	43.8	....	32	.....	27	1.01	.73	4.6
Oct	......	.34	......	58.1	48.2	73	26	63.7	32.7	....	27	.....	31	.03	.03	2.5
Nov	......	.76	......	50 0	39.2	67	17	56.5	21.9	....	17	.....	28	T.	T.	1.7
Dec	......	.95	......	40.2	35.2	60	15	45.8	24.7	....	23	.....	53	2.20	1.64	3.1
Means	......	......	......	57.3	48.0	92	—22	61.9	34.1	....	26	.....	36	13.27	......	3.7

* Barometric observations commenced Feb. 6, 1890.

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

BUFFALO, N. Y.

[H=690. T=102.5. h=92.75.]

Months and year.	Wind.												Number of days—									
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	16.1	90	SW.	W.	2	2	6	4	9	14	16	9	0	1	15	15	22	8	24	0	0	0
Feb	14.4	59	W.	NE.	1	9	11	4	8	4	12	7	0	1	12	15	17	7	22	0	1	0
Mar	13.2	46	W.	SW.	3	8	4	4	5	10	19	8	1	3	12	16	19	10	24	0	1	0
Apr	10.3	53	SW.	SW.	5	8	4	4	5	22	10	2	0	10	9	11	11	0	7	0	3	0
May	9.4	48	SW.	SW.	1	14	6	5	9	16	5	5	1	5	19	7	21	0	0	0	5	0
June	7.8	33	SW.	SW.	3	10	3	5	4	19	8	7	1	9	14	7	15	0	0	0	5	0
July	9.4	47	NW.	SW.	5	6	1	6	6	19	8	11	0	13	15	3	11	0	0	0	6	0
Aug	9.2	36	SW.	NW.	5	9	5	5	7	9	8	14	0	4	23	4	14	0	0	0	5	0
Sept	7.9	41	W.	SW.	3	7	6	6	8	12	4	4	0	10	11	9	14	0	0	0	1	0
Oct	10.0	48	W.	NE.	5	14	5	4	8	2	11	12	1	2	10	19	25	0	0	0	0	1
Nov	13.6	52	SW.	NW.	2	3	6	1	10	12	10	16	0	5	9	16	15	2	11	0	0	0
Dec	14.2	54	SW.	NW.	3	14	6	5	2	11	13	8	0	2	14	15	20	15	28	0	0	0
Means	11.3	....	....	SW.	38	114	63	53	81	150	124	103	4	65	163	137	204	42	116	0	27	1

CAIRO, ILL.

[H=350. T=87.6. h=78.]

Jan	10.6	47	W.	S.	11	6	4	7	17	5	6	6	0	7	3	21	18	3	10	0	1	0
Feb	9.5	30	SW.	N.	13	6	5	7	10	3	4	7	1	6	5	17	14	3	7	0	4	0
Mar	11.0	58	W.	N.	14	11	5	2	10	5	8	7	0	10	6	15	12	5	10	0	3	0
Apr	10.3	30	SW.	S.	12	10	4	7	14	5	4	4	0	10	5	15	10	0	0	0	1	0
May	7.6	36	SE.	S.	13	7	2	6	18	5	6	5	0	12	13	6	13	0	0	0	4	0
June	7.0	27	SW.	SW.	4	3	3	1	20	21	2	2	4	6	20	4	4	0	0	12	2	0
July	5.5	48	NE.	SW.	14	7	0	3	7	15	8	2	6	14	10	7	5	0	0	13	6	0
Aug	5.4	32	W.	S.	8	10	9	2	14	7	4	7	1	10	6	15	12	0	0	5	8	0
Sept	6.5	31	N.	N.	16	9	5	4	8	3	4	9	2	7	8	15	16	0	0	0	1	0
Oct	6.6	40	SW.	S.	4	3	1	8	16	5	12	9	4	10	10	11	11	0	1	0	2	0
Nov	7.6	32	N.	N.	16	5	0	1	9	9	9	9	2	13	9	8	9	0	1	0	0	0
Dec	8.5	35	N.	SW.	9	4	6	4	10	14	4	10	1	13	5	13	10	2	15	0	0	0
Means	8.0	....	....	S.	134	81	44	52	158	97	71	77	21	118	100	147	134	13	44	30	32	0

CARSON CITY, NEV.

[H=1,748. T=21. h—42.]

Jan	....	....	....	....	....	....	....	....	....	....	....	....	....	12	6	13	16	13	20	0	0	0
Feb	....	....	....	....	....	....	....	....	....	....	....	....	....	9	9	10	9	3	22	0	0	0
Mar	....	....	....	....	....	....	....	....	....	....	....	....	....	11	12	8	9	0	18	0	0	0
Apr	....	....	....	....	....	....	....	....	....	....	....	....	....	15	8	7	3	0	9	0	1	0
May	....	....	....	....	....	....	....	....	....	....	....	....	....	18	8	5	4	0	0	0	4	0
June	....	....	....	....	....	....	....	....	....	....	....	....	....	19	9	2	0	0	1	0	0	0
July	....	....	....	....	....	....	....	....	....	....	....	....	....	20	9	2	0	0	0	5	0	0
Aug	....	....	....	....	....	....	....	....	....	....	....	....	....	17	10	4	6	0	0	2	4	0
Sept	....	....	....	....	....	....	....	....	....	....	....	....	....	14	6	10	5	0	0	0	2	0
Oct	....	....	....	....	....	....	....	....	....	....	....	....	....	20	8	3	1	0	19	0	0	0
Nov	....	....	....	....	....	....	....	....	....	....	....	....	....	23	6	1	0	0	27	0	0	0
Dec	....	....	....	....	....	....	....	....	....	....	....	....	....	19	7	5	5	0	26	0	0	0
Means	....	....	....	....	....	....	....	....	....	....	....	....	....	197	98	70	58	16	151	7	11	0

† 8 a. m. observation discontinued July 1.

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

CHARLESTON, S. C.

[Lat., 32° 47′ N.; long., 79° 56′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	30.27	.67	53.0	59.1	50.3	78	36	66.8	51.8	50	54	88	84	1.28	.90	4.1
Feb	30.11	.51	55.8	59.0	60.6	70	39	67.9	53.2	52	53	88	82	1.28	.49	5.1
Mar	30.08	.62	52.4	58.7	56.4	82	25	63.9	48.8	47	50	83	80	1.72	.69	5.9
Apr	30.12	.74	62.1	64.2	64.8	88	47	72.3	57.3	57	58	83	81	2.58	1.46	5.5
May	29.96	.52	71.6	72.4	73.0	86	51	79.6	66.4	64	67	79	84	3.67	1.33	5.0
June	30.01	.47	79.7	79.7	82.2	98	69	89.7	74.8	74	74	84	83	1.82	.52	7.1
July	30.01	.56	79.0	78.8	79.8	92	66	86.3	73.4	72	73	81	83	12.87	4.62	7.0
Aug	30.04	.39	77.2	78.8	79.8	93	65	86.3	73.2	71	72	82	82	5.16	1.72	4.7
Sept	30.02	.28	74.0	75.0	76.2	90	58	82.4	70.1	70	71	88	87	11.89	5.42	6.9
Oct	29.96	.55	63.4	67.4	67.6	89	41	74.8	60.3	57	60	81	78	4.64	4.05	4.3
Nov	30.11	.50	57.4	61.7	62.2	81	38	69.8	54.6	53	55	84	80	.42	.31	4.2
Dec	30.10	.76	46.2	51.4	51.4	75	34	59.4	43.3	41	46	83	84	1.01	.72	3.2
Means	30.07	.55	61.4	67.0	67.8	98	25	74.9	60.6	59	61	84	82	47.84	......	5.2

CHARLOTTE, N. C.

[Lat., 35° 13′ N.; long., 80° 51′ W.]

Jan	29.45	.71	41.9	51.7	50.8	77	25	59.5	42.0	38	39	80	66	.94	.64	5.7
Feb	29.28	.71	47.6	53.8	52.8	79	28	61.6	44.1	42	44	82	70	3.65	1.82	5.2
Mar	29.25	.84	41.1	50.1	49.6	76	19	59.6	39.5	36	35	75	60	3.08	.80	4.6
Apr	29.31	.88	55.4	62.1	60.6	86	36	71.3	50.0	46	46	71	58	2.34	.90	3.5
May	29.16	.58	65.1	70.9	69.8	90	42	80.6	58.9	56	57	74	63	7.07	3.03	3.4
June	29.22	.51	76.8	79.8	80.2	98	64	91.5	69.0	65	65	69	61	.52	.22	2.8
July	29.24	.57	73.5	76.2	77.3	96	57	86.5	68.1	66	66	80	72	6.07	1.10	4.2
Aug	29.27	.47	71.0	73.5	75.3	92	57	84.8	65.8	64	65	80	76	5.35	2.10	4.0
Sept	29.28	.35	66.4	69.7	70.8	91	50	78.6	63.0	63	64	90	83	5.54	1.07	5.9
Oct	29.16	.78	55.1	59.3	59.7	86	32	68.7	50.7	48	49	79	70	4.89	2.84	3.5
Nov	29.30	.51	48.4	55.9	55.4	78	29	65.6	45.1	41	43	78	64	.23	.13	3.5
Dec	29.27	.99	36.6	44.1	42.9	68	24	52.2	33.6	39	32	77	65	3.81	1.79	3.7
Means	29.27	.66	57.1	62.3	62.1	98	19	71.7	52.5	50	50	78	67	43.49	......	4.2

CHATTANOOGA, TENN.

[Lat., 35° 4′ N.; long., 85° 15′ W.]

Jan	29.48	.60	46.3	52.2	50.4	75	25	58.6	42.3	41	45	84	78	4.68	1.56	7.0
Feb	29.31	.65	48.3	55.3	51.0	78	27	63.5	44.5	43	47	84	75	7.85	2.02	6.5
Mar	29.29	.81	43.1	51.1	48.8	76	15	58.2	39.4	34	40	71	68	4.78	.96	5.7
Apr	29.36	.66	57.5	63.8	62.4	86	38	71.3	53.4	48	49	71	62	3.94	1.14	5.5
May	29.18	.61	62.8	69.9	68.0	89	40	78.0	58.0	56	58	78	66	3.95	.85	4.6
June	29.26	.37	74.2	79.7	78.9	95	62	89.3	68.5	67	68	78	69	3.12	1.56	5.1
July	29.21	.48	73.7	78.5	78.8	95	64	88.5	69.2	68	69	81	73	4.43	2.88	5.3
Aug	29.29	.32	70.3	75.1	75.0	93	56	83.4	66.6	65	66	83	75	5.15	1.73	4.9
Sept	29.28	.31	66.3	70.7	71.5	90	55	78.9	64.1	64	68	91	86	7.10	2.14	5.7
Oct	29.23	.68	53.5	59.6	59.5	84	33	68.3	50.7	49	51	85	74	4.13	1.76	4.3
Nov	29.35	.49	47.1	57.7	55.8	79	28	67.0	44.6	41	44	82	63	.16	.10	2.6
Dec	29.35	.66	38.2	46.5	44.8	65	26	51.4	35.1	32	36	78	68	3.18	1.24	5.1
Means	29.30	.56	56.8	63.3	62.3	95	15	71.6	53.0	51	53	80	71	52.42	......	5.2

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

CHARLESTON, S. C.

[H=52. T=60. h=55.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudiness.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	7.0	35	E.	SW.	16	12	1	3	1	17	5	2	5	12	14	5	8	0	0	0	0	0
Feb	6.4	26	NE.	SW.	11	8	1	0	1	20	5	2	8	12	5	11	5	0	0	0	0	0
Mar	8.2	36	SW.	SW.	6	9	3	1	4	17	12	6	4	10	6	15	11	0	4	0	0	0
Apr	7.5	30	E.	SW.	5	10	7	3	2	18	8	2	5	11	9	10	7	0	0	0	2	0
May	7.7	27	S.	SW.	4	4	8	3	8	25	7	2	1	13	8	10	16	0	0	0	1	0
June	5.8	27	SW.	SW.	1	3	8	4	1	27	10	3	3	1	10	19	9	0	0	16	3	0
July	7.9	36	SW.	SW.	0	8	7	3	8	22	8	2	4	6	7	18	18	0	0	4	3	0
Aug	6.7	25	S.	SW.	5	6	4	7	8	23	3	4	2	11	14	6	10	0	0	3	1	0
Sept	5.6	36	E.	NE.	6	17	7	5	6	9	2	3	5	4	8	18	18	0	0	0	0	0
Oct	5.5	36	E.	W.	11	8	3	1	0	11	11	6	11	14	11	6	9	0	0	0	0	0
Nov	5.8	22	E.	N.	13	12	10	1	1	11	9	2	1	15	7	8	4	0	0	0	0	0
Dec	8.1	30	NW.	W.	10	9	2	3	0	8	13	13	4	21	3	7	5	0	0	0	0	0
Mean	6.8	....	......	SW.	88	106	61	34	40	208	93	47	53	130	102	138	120	0	4	23	10	0

CHARLOTTE, N. C.

[H=808. T=55.7. h=47.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudiness.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	5.9	25	SW.	SW.	11	10	2	0	11	15	7	4	2	10	9	12	7	0	5	0	0	0
Feb	6.6	30	SE.	S.	7	12	1	4	13	9	6	4	0	12	7	9	11	0	2	0	1	0
Mar	7.5	28	W.	S.	10	9	5	1	14	10	5	7	1	14	9	8	11	0	6	0	2	0
Apr	6.4	25	W.	S.	5	11	8	1	14	10	4	5	2	18	6	6	10	0	0	0	2	0
May	5.2	24	S.	SW.	3	7	3	7	10	16	6	7	3	18	8	5	13	0	0	1	4	0
June	4.5	23	NE.	W.	5	9	7	1	7	10	12	4	5	23	7	0	6	0	0	16	6	0
July	4.6	24	SW.	S.	5	11	8	0	16	14	4	0	4	18	8	5	12	0	0	18	5	0
Aug	4.1	20	S.	S.	8	9	4	3	18	11	3	2	4	15	12	4	9	0	0	4	3	0
Sept	4.5	18	NE.	NE.	5	19	9	2	6	5	7	3	4	10	6	14	18	0	0	1	5	0
Oct	4.9	23	W.	SW.	6	8	2	1	9	13	11	8	4	19	5	7	7	0	1	0	0	0
Nov	4.0	24	W.	S.	5	5	5	0	23	5	8	3	6	19	4	7	4	0	3	0	0	0
Dec	5.0	24	W.	SW.	14	6	2	6	6	15	6	4	3	21	2	8	8	0	10	0	0	0
Means	5.3	....	......	S.	84	118	56	26	147	133	79	51	38	197	83	85	116	0	30	35	28	0

CHATTANOOGA, TENN.

[H=783. T=71. h=59.7.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudiness.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	6.8	35	SW.	S.	5	8	4	8	21	11	1	4	0	3	15	13	12	0	5	0	0	0
Feb	6.3	42	SW.	SW.	2	9	4	7	10	14	0	6	4	6	10	12	12	0	3	0	4	0
Mar	6.0	31	SW.	NW.	9	6	2	6	11	11	5	12	0	7	15	9	13	2	11	0	0	0
Apr	5.9	29	NW.	SW.	2	8	1	10	7	16	5	11	0	10	11	9	12	0	0	0	2	0
May	4.3	27	NW.	SW.	3	5	3	7	10	14	6	11	3	12	13	6	13	0	0	0	7	0
June	4.3	22	SE.	W.	5	5	3	6	10	10	13	6	2	7	19	4	14	0	0	16	16	0
July	4.5	36	E.	S.	5	7	7	8	13	6	9	5	2	7	17	7	16	0	0	15	12	0
Aug	4.4	26	SW.	SW.	5	11	2	5	8	13	9	7	2	11	13	7	17	0	0	2	9	0
Sept	3.7	21	NW.	NE.	4	16	2	7	8	2	9	10	2	6	14	10	16	0	0	1	3	0
Oct	5.4	27	NW.	NW.	6	3	5	4	5	6	8	19	6	14	11	6	12	0	0	0	2	0
Nov	4.4	80	S.	NW.	9	4	2	6	6	4	11	11	7	22	5	3	3	0	3	0	0	0
Dec	6.9	33	NW.	NW.	8	10	4	3	10	7	9	11	0	12	8	11	11	0	8	0	0	0
Means	5.3	....	......	S.	63	92	39	77	119	114	85	113	28	117	151	97	151	2	30	34	55	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

CHEYENNE, WYO.

[Lat., 41° 8′ N.; long. 104° 48′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	23.88	.66	20.8	25.3	24.8	59	2	36.6	13.1	1	5	52	46	.16	.11	4.8
Feb	23.87	.87	23.2	28.9	28.2	61	20	38.9	17.4	5	5	53	42	.59	.20	5.9
Mar	23.92	.74	28.1	38.7	35.0	62	2	44.9	25.2	10	8	52	32	.17	.08	6.0
Apr	24.00	.50	35.9	47.3	43.2	72	13	53.9	32.5	23	20	64	57	3.93	.63	4.7
May	23.97	.45	44.1	56.7	51.7	80	28	61.5	38.9	32	30	66	42	.81	.22	5.5
June	24.02	.50	52.7	70.3	61.0	90	39	75.6	45.4	33	23	48	22	.65	.29	3.8
July	24.12	.35	60.9	76.8	70.2	92	48	84.4	55.9	43	38	56	30	3.64	1.45	3.9
Aug	24.13	.32	54.1	69.8	64.2	89	39	77.5	50.8	40	41	60	41	3.18	1.37	4.7
Sept	24.10	.51	45.6	64.4	56.8	84	28	72.2	41.4	24	22	46	23	T	T	5.0
Oct	24.02	.59	37.9	46.9	45.3	69	22	56.9	33.7	19	22	52	43	.76	.43	5.2
Nov	24.11	.84	30.2	37.6	37.8	66	11	49.6	25.9	14	8	54	32	.47	.28	2.8
Dec	24.00	.76	31.2	36.0	36.1	61	13	47.0	25.2	15	6	53	32	.11	.07	3.4
Means	24.01	.59	38.8	40.9	46.2	92	20	58.6	33.8	22	20	55	37	14.47	......	4.6

CHICAGO, ILL.

[Lat., 41° 52′ N.; long., 87° 38′ W.]

Jan	29.36	1.40	28.6	33.3	30.8	62	–5	38.0	23.7	24	27	84	78	2.98	.94	5.9
Feb	29.16	.87	29.2	34.2	32.4	59	3	38.7	26.2	25	28	85	78	2.42	.53	6.5
Mar	29.18	1.11	25.3	31.3	29.5	56	0	35.7	23.3	19	22	79	70	2.10	.60	5.1
Apr	29.21	1.02	42.9	45.9	45.6	75	28	52.8	38.4	35	36	74	70	3.23	.90	4.6
May	29.04	.79	50.0	55.1	53.4	83	31	61.5	45.2	43	42	78	64	5.13	2.60	6.1
June	29.11	.63	67.9	71.3	70.2	92	52	77.6	62.7	60	60	76	70	3.25	1.03	5.1
July	29.14	.50	69.6	74.1	72.1	93	56	78.9	65.3	58	59	66	61	2.57	1.31	3.5
Aug	29.19	.52	64.4	69.0	67.6	96	51	73.7	61.4	56	59	76	71	2.58	1.47	4.7
Sept	29.23	.66	57.0	63.0	60.4	88	39	66.8	54.0	59	54	79	72	1.39	.98	5.1
Oct	29.06	.74	49.2	52.1	51.4	73	28	56.6	46.1	45	45	86	77	4.20	1.16	7.0
Nov	29.17	.69	37.8	43.8	41.9	67	27	48.7	35.1	32	32	80	66	1.59	.84	5.3
Dec	29.20	.83	27.7	31.7	30.0	53	8	36.6	24.5	22	33	80	73	1.25	.47	5.3
Means	29.16	.81	45.8	50.4	48.8	96	–5	55.5	42.2	39	41	79	71	32.69	9	5.4

CINCINNATI, OHIO.

[Lat., 39° 6′ N.; long., 84° 30′ W.]

Jan	29.55	.96	40.1	44.1	41.5	71	10	48.9	34.1	35	36	81	76	5.28	1.33	7.6
Feb	29.41	.93	39.7	44.2	43.1	70	18	51.9	34.3	34	35	81	72	4.63	1.24	7.2
Mar	29.42	1.07	33.9	40.6	39.7	67	7	41.4	31.0	27	30	76	69	6.26	1.06	8.4
Apr	29.45	.91	49.6	59.2	55.8	80	31	65.8	45.7	39	42	68	56	2.63	1.09	6.5
May	29.30	.69	59.2	66.0	63.8	89	39	74.5	53.2	50	50	71	58	3.58	1.16	5.7
June	29.36	.48	72.7	80.0	77.8	98	51	87.2	68.3	63	63	72	58	6.00	1.55	5.6
July	29.37	.50	70.9	81.4	77.0	95	58	87.1	66.8	60	62	70	53	1.46	1.16	4.1
Aug	29.42	.56	67.3	75.0	72.6	94	51	81.4	63.7	61	61	80	63	5.91	2.66	6.4
Sept	29.46	.40	60.8	67.8	65.8	89	41	74.5	57.1	56	58	84	71	3.28	1.60	5.9
Oct	29.32	.76	51.4	57.6	56.5	83	31	64.0	49.0	47	48	86	73	4.14	1.25	6.6
Nov	29.46	.62	43.4	49.4	47.8	72	27	55.7	40.0	36	39	76	71	2.65	.80	5.9
Dec	29.46	.77	31.5	37.0	35.8	56	16	42.9	28.8	24	23	76	68	1.88	.72	6.3
Means	29.42	.72	51.7	58.5	56.4	98	7	65.2	47.7	44	46	77	66	47.70	......	6.4

Annual Meteorological Summary for the Year ending December 31, 1890—Continued.

CHEYENNE, WYO.

[H=6,105. T=58. h=50.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	12.8	58	W.	W.	6	3	1	1	5	11	21	12	2	10	16	5	6	11	29	0	0	0
Feb	13.6	64	W.	W.	3	4	2	7	0	7	17	15	1	6	13	9	9	6	25	0	0	0
Mar	15.0	42	NW.	NW.	2	1	0	4	5	3	20	23	4	6	14	11	5	4	26	0	0	0
Apr	9.4	56	NW.	NW.	5	3	2	5	8	10	9	15	3	13	7	10	12	0	13	0	4	0
May	11.0	45	N.	NW.	12	6	0	2	12	7	7	16	0	6	9	6	8	9	4	0	0	0
June	9.2	52	S.	NW.	8	3	1	3	8	6	4	23	4	19	5	6	7	0	1	0	3	0
July	9.3	41	S.	NW.	7	4	2	5	7	9	8	18	2	16	12	3	10	0	0	3	7	0
Aug	9.0	37	SW.	NW.	1	1	1	4	16	6	7	16	0	12	12	7	14	0	0	0	3	0
Sept	9.9	40	W.	NW.	2	1	3	3	9	10	12	20	0	9	15	6	0	0	1	0	1	0
Oct	12.2	47	W.	NW.	5	0	1	3	2	8	14	29	0	13	7	11	9	0	12	0	1	0
Nov	10.2	36	W.	NW.	9	2	1	3	0	8	9	27	1	20	6	4	3	1	23	0	0	0
Dec	12.8	46	W.	NW.	6	0	0	1	3	7	21	24	0	18	9	4	2	3	24	0	0	0
Means	11.2	....	.....	NW.	76	28	14	41	75	92	149	238	17	148	135	82	85	25	158	3	19	0

CHICAGO, ILL.

[H=824. T=241. h=238.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	10.7	42	NW	SW.	5	2	1	7	6	19	10	12	0	7	13	11	14	9	21	0	1	0
Feb	18.0	48	W.	SW.	1	12	3	7	3	13	7	10	0	7	6	15	12	6	20	0	0	0
Mar	18.6	68	NE.	NW.	5	11	5	8	3	8	7	15	0	9	13	9	15	9	24	0	1	0
Apr	20.7	56	SW.	NE.	4	26	7	6	7	5	2	3	0	13	9	8	12	0	3	0	4	0
May	18.2	59	NE.	NE.	1	15	3	8	5	15	7	8	0	8	10	13	16	0	0	0	5	0
June	12.8	53	SW.	SE.	3	13	5	11	6	11	9	2	0	8	17	5	14	0	0	1	12	0
July	15.4	52	NE.	SW.	3	13	4	13	6	14	4	4	1	13	17	1	5	0	0	4	4	0
Aug	13.8	45	S.	NE.	4	16	7	10	6	11	4	4	0	12	10	9	10	0	0	2	3	0
Sept	17.3	49	NW.	NE.	6	13	6	10	7	10	3	5	0	9	12	9	7	0	0	0	2	0
Oct	14.5	50	SW.	N.	8	7	4	9	6	10	2	15	1	4	9	18	15	0	2	0	1	0
Nov	17.0	45	SW.	SW.	3	5	4	4	3	16	13	12	0	11	7	12	8	0	7	0	0	0
Dec	18.3	54	SW.	SW.	10	4	2	8	5	12	10	10	1	10	10	11	8	10	25	0	0	0
Means	16.3	....	.....	SW.	53	137	51	101	63	144	78	100	3	111	133	121	136	34	102	7	33	0

CINCINNATI, OHIO.

[H=628. T=153.1. h=145.3.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	8.7	38	SW.	SW.	11	6	4	3	7	20	1	6	4	4	7	20	19	3	12	0	0	0
Feb	8.3	27	NW.	SW.	6	4	6	5	5	10	4	11	5	6	3	10	14	0	10	0	3	0
Mar	8.8	38	SW.	NE.	8	8	3	9	0	7	6	15	6	1	11	19	15	4	14	0	4	0
Apr	6.7	34	W.	NE.	0	16	4	6	1	11	3	5	14	7	10	13	17	0	1	0	2	0
May	6.7	34	SW.	SW.	3	5	3	7	11	16	1	11	5	9	9	13	15	0	0	0	4	0
June	6.2	37	NW.	W.	2	7	6	5	8	10	11	9	2	6	18	6	14	0	0	10	8	0
July	6.2	23	SW.	SW.	4	11	4	6	11	17	2	6	1	15	13	3	4	0	0	12	2	0
Aug	5.6	35	NW.	SW.	4	8	7	9	9	9	4	9	3	4	17	10	15	0	0	5	3	0
Sept	5.9	22	NE.	NE.	1	17	9	7	6	7	3	4	6	8	11	11	14	0	0	0	1	0
Oct	7.4	38	W.	SW.	0	5	2	4	10	19	8	11	3	4	13	14	16	0	0	0	1	0
Nov	7.6	29	S.	S.	4	5	3	8	15	10	3	11	1	8	10	12	10	0	4	0	0	0
Dec	8.8	82	SW.	NW.	4	5	6	4	13	9	5	12	4	4	15	12	9	3	21	0	0	0
Means	7.2	....	.....	SW.	47	97	57	73	96	145	51	110	54	76	137	152	162	10	62	27	28	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

CLEVELAND, OHIO.

[Lat., 41° 31′ N.; long., 81° 42′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a.m.	Temperature. 8 p.m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a.m.	Dew point. 8 p.m.	Relative humidity. 8 a.m.	Relative humidity. 8 p.m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.35	1.12	36.2	37.8	37.0	68	10	44.5	29.5	30	30	78	75	4.03	.80	7.4
Feb	29.25	.94	34.2	37.1	36.3	65	15	43.7	28.9	29	29	80	75	4.58	1.80	7.5
Mar	29.26	1.32	30.4	32.9	32.0	62	6	37.8	26.1	25	23	80	68	3.93	1.02	7.6
Apr	29.32	1.17	45.1	49.0	46.6	76	26	54.8	38.4	36	37	73	65	2.49	.64	6.2
May	29.15	.74	54.5	57.8	55.8	82	32	63.8	47.8	47	47	77	70	6.16	1.16	6.2
June	29.22	.62	69.1	72.3	70.4	89	49	78.5	62.2	61	61	77	70	4.50	1.95	5.3
July	29.24	.60	69.8	73.3	71.4	97	50	80.3	62.6	59	61	70	66	2.77	1.65	3.9
Aug	29.27	.55	65.9	69.6	67.6	86	46	74.5	60.8	58	58	75	68	3.14	1.30	5.7
Sept	29.34	.55	58.0	62.6	62.0	89	42	70.2	53.8	54	56	86	81	5.58	2.13	5.9
Oct	29.13	1.00	49.8	53.8	53.2	81	33	59.7	46.7	45	47	84	79	5.85	.93	7.7
Nov	29.25	.83	41.3	44.6	43.4	68	28	49.3	37.6	33	35	74	69	3.04	.97	6.9
Dec	29.26	.89	28.5	31.1	30.0	50	14	35.1	25.0	22	22	78	71	1.75	.33	7.8
Means	29.25	.86	48.6	51.8	50.5	97	6	57.7	43.3	42	42	78	71	47.82	......	6.4

COLORADO SPRINGS, COLO.

[Lat., 38° 51′ N.; long., 104° 47′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a.m.	Temperature. 8 p.m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a.m.	Dew point. 8 p.m.	Relative humidity. 8 a.m.	Relative humidity. 8 p.m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
Jan	......	......	17.9	30.0	28.0	73	−5	43.1	12.8	10	12	73	52	0.41	0.30	3.3
Feb	......	......	22.1	36.2	32.3	77	−12	46.5	18.1	14	12	72	44	0.13	0.10	3.0
Mar	......	......	28.2	45.2	38.6	70	−2	52.8	24.3	19	18	70	40	0.39	0.26	4.2
Apr	......	......	38.0	51.3	47.5	74	16	59.9	35.1	29	26	71	46	3.90	2.34	4.7
May	......	......	46.8	62.8	55.2	85	30	68.3	42.0	35	27	67	34	1.43	0.52	4.5
June	......	......	54.8	74.7	65.1	92	38	80.2	50.0	42	26	62	23	0.44	0.22	3.5
July	......	......	62.7	76.2	72.0	94	50	86.4	57.5	50	46	62	37	1.64	1.00	4.8
Aug	......	......	57.4	71.7	67.2	96	44	81.7	52.7	46	44	68	46	4.99	3.62	4.9
Sept	......	......	48.6	65.7	59.7	86	32	74.5	44.9	33	34	57	34	0.17	0.12	4.6
Oct	......	......	38.2	53.0	40.4	74	22	64.0	34.7	20	19	51	32	0.40	0.23	3.0
Nov	......	......	29.5	41.4	40.4	74	15	54.7	26.2	15	13	57	38	0.28	0.28	2.0
Dec	......	......	......	......	......	....	....	......	......	....	....	....	......	......	......	....
Means	......	......	......	......	......	....	....	......	......	....	....	....	......	......	......	....

COLUMBIA, MO.

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a.m.	Temperature. 8 p.m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a.m.	Dew point. 8 p.m.	Relative humidity. 8 a.m.	Relative humidity. 8 p.m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
Jan	......	......	......	34.5	36.2	70	0	47.9	24.6	....	31	.....	87	4.02	1.85	6.9
Feb	......	......	......	36.6	37.6	75	−1	48.1	27.0	....	30	.....	78	2.34	0.48	7.4
Mar	......	......	......	38.7	37.0	70	−6	49.1	24.8	....	31	.....	75	2.80	1.25	6.4
Apr	......	......	......	58.0	56.8	88	29	68.5	45.2	....	48	.....	72	2.17	0.84	6.6
May	......	......	......	64.5	63.3	90	33	76.5	50.1	....	55	.....	73	3.92	1.07	5.9
June	......	......	......	79.2	77.2	100	48	89.5	64.9	....	68	.....	69	3.40	1.35	4.3
July	......	......	......	81.7	79.0	104	54	92.8	65.2	....	60	.....	67	4.97	2.04	4.9
Aug	......	......	......	74.5	72.3	99	47	86.2	58.4	....	65	.....	73	5.47	1.97	4.5
Sept	......	......	......	62.5	63.5	90	34	75.3	51.7	....	58	.....	86	3.97	1.55	6.0
Oct	......	......	......	55.0	56.1	88	22	68.5	43.7	....	46	.....	73	2.10	0.91	5.2
Nov	......	......	......	45.8	47.2	80	23	60.6	33.0	....	36	.....	70	2.34	0.76	4.2
Dec	......	......	......	36.9	37.4	65	7	48.8	26.1	....	27	.....	69	0.38	0.37	5.8
Means	......	......	......	55.7	55.3	104	−6	67.6	43.0	....	47	.....	74	37.88	......	5.7

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

CLEVELAND, OHIO.

[H=751. T=96.75. h=89.00.]

Months and years.	Wind.													Number of days.								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	10.5	47	S.	SW.	3	2	1	3	14	17	10	12	...	3	8	20	20	5	18	0	0	0
Feb	9.3	36	SW.	SW.	1	6	5	3	13	11	6	11	...	5	5	18	15	3	21	0	1	0
Mar	9.0	31	E.	NW.	1	10	3	7	6	10	11	14	0	4	7	20	18	10	22	0	4	0
Apr	8.5	30	SW.	NE.	9	14	1	12	10	6	1	5	2	10	12	8	14	0	5	0	3	0
May	7.7	35	NE.	SE.	2	11	1	14	9	10	6	7	2	9	11	11	21	0	0	0	7	0
June	5.7	35	NE.	NW.	5	6	2	13	9	8	3	13	1	8	15	7	10	0	0	0	7	0
July	7.2	29	W.	SE.	5	14	2	14	6	13	0	8	0	15	14	2	7	0	0	4	5	0
Aug	6.8	27	S.	NW.	4	11	2	9	10	8	3	13	2	7	14	10	12	0	0	1	1	0
Sept	7.0	29	SW.	SE.	3	12	5	10	6	6	4	4	1	9	10	11	13	0	0	0	0	0
Oct	7.8	29	NW	SW.	3	4	2	14	5	16	4	13	1	1	10	20	25	0	0	0	2	0
Nov	9.8	62	SW.	SW.	3	3	4	7	7	19	5	12	0	8	7	15	16	0	7	0	1	0
Dec	10.4	37	SW.	SW.	2	9	2	10	5	17	6	11	0	3	8	20	12	10	28	0	0	0
Means	8.3	.....	.....	SW.	41	102	30	125	100	141	59	123	9	82	121	162	183	28	101	5	31	0

COLORADO SPRINGS, COLO

[H= —. T= —. h= —.]

Jan	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17	10	4	2	7	30	0	0	0
Feb	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16	10	2	8	4	24	0	0	0
Mar	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13	13	5	3	3	25	0	0	0
Apr	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10	13	7	7	1	9	0	1	0
May	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10	16	5	8	0	1	0	3	0
June	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16	12	2	4	0	0	2	8	0
July	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	26	2	13	0	0	13	12	0
Aug	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10	15	6	9	0	0	2	8	0
Sept	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10	16	4	3	0	0	0	0	0
Oct	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	20	4	7	5	0	11	0	0	0
Nov	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23	5	2	1	1	25	0	0	0
Dec	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Means	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

COLUMBIA, MO.

[H=760. T=4. h=1.]

Jan	(*)	(*)	.....	S.	4	1	1	4	8	3	8	7	0	5	9	17	10	5	21	0	1	0
Feb	8.5	32	NW	NW.	3	3	3	2	4	3	3	5	2	5	6	17	12	5	19	0	2	0
Mar	9.1	48	SW	NW.	3	2	6	2	6	3	1	8	0	7	10	14	10	5	20	0	8	0
Apr	9.6	40	S.	NW.	1	9	4	4	4	3	0	4	1	7	8	15	9	0	1	0	4	0
May	7.0	30	W.	SE.	1	2	4	6	4	4	4	5	1	9	9	18	12	0	0	0	10	0
June	5.5	48	SE.	S.	1	1	5	7	10	4	0	2	0	10	18	2	6	0	0	18	13	0
July	4.7	21	SW	S.	4	1	5	3	9	2	2	5	0	10	15	6	7	0	0	21	10	0
Aug	4.6	22	S.	SE.	5	2	5	7	3	3	2	3	1	16	7	8	9	0	0	8	6	0
Sept	5.4	24	NW	NE.	5	8	4	6	4	1	0	2	0	8	10	12	7	0	0	1	4	0
Oct	7.1	36	NW	S.	2	0	4	4	8	4	4	5	0	10	11	10	8	0	4	0	4	0
Nov	6.8	24	S.	SW.	4	4	2	1	4	8	6	1	0	19	2	9	6	0	13	0	0	0
Dec	8.0	83	N.	N.	6	3	3	4	5	4	5	1	0	10	9	12	8	1	22	0	0	0
Means	(*)	.....	.....	S.	39	36	46	50	69	42	30	48	5	116	114	185	99	16	100	48	57	0

*No record from 2 p.m. January 12 to 12 noon February 1.

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

COLUMBUS, OHIO.

[Lat., 39° 58' N.; long., 83° 0' W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a. m.	Dew point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.30	.95	37.0	40.7	39.1	67	9	46.5	31.7	31	34	80	77	5.73	1.60	6.4
Feb	29.17	.95	37.6	42.2	40.6	66	17	47.6	33.6	31	33	78	72	6.12	2.30	6.8
Mar	29.18	1.13	31.3	37.1	35.2	62	7	41.9	28.4	25	27	78	68	5.63	1.25	7.2
Apr	29.21	1.02	47.8	56.1	52.3	75	28	62.0	42.6	38	41	70	59	4.32	1.61	5.2
May	29.06	.70	56.8	62.7	60.0	86	35	69.0	51.1	50	50	79	65	5.12	1.06	6.1
June	29.13	.54	71.0	75.5	71.6	93	53	81.5	64.6	64	64	78	69	4.95	1.10	4.9
July	29.15	.53	69.5	76.4	73.6	96	50	83.8	63.3	60	60	73	57	1.80	44	2.5
Aug	29.18	.58	65.9	71.9	70.2	94	48	79.1	61.2	58	58	77	64	2.75	.50	4.0
Sept	29.23	.44	59.0	64.7	63.1	87	38	71.7	54.5	54	55	83	72	7.13	2.25	5.0
Oct	29.06	.90	49.2	54.6	53.8	82	33	60.9	46.6	45	46	85	73	3.02	.75	6.6
Nov	29.19	.68	40.0	46.3	44.6	70	24	51.0	37.3	33	36	78	68	1.97	.60	6.1
Dec	29.20	.82	28.6	32.5	31.8	53	14	37.3	26.4	23	23	80	70	2.19	.76	6.0
Means	29.17	.77	49.5	55.1	53.2	96	7	61.4	45.1	43	44	78	68	50.73	......	5.6

CONCORDIA, KANS.

[Lat., 39° 35' N.; long., 97° 41' W.]

Jan	28.68	1.06	15.0	24.2	21.0	58	—14	30.1	11.9	11	17	85	76	1.38	.80	4.8
Feb	28.60	1.00	21.4	31.6	29.4	71	— 7	30.1	19.7	17	22	84	70	.25	.20	4.0
Mar	28.57	1.52	28.4	42.7	38.0	70	9	49.9	26.2	23	26	81	58	.14	.08	4.4
Apr	28.55	.88	46.6	60.7	55.6	92	24	67.2	44.0	39	41	77	54	2.22	.96	4.2
May	28.43	.71	54.5	69.0	62.8	87	31	75.4	50.1	47	45	76	46	2.23	.60	3.3
June	28.44	.82	68.4	82.5	75.6	97	49	87.2	64.1	61	61	77	50	3.63	1.22	3.2
July	28.50	.39	73.7	88.4	82.3	103	58	95.2	69.4	64	63	72	46	.23	.10	2.2
Aug	28.57	.48	66.0	78.0	73.8	101	49	85.6	62.0	60	62	81	60	3.33	1.07	3.7
Sept	28.60	.78	54.6	68.4	64.9	97	33	77.5	52.3	49	53	82	61	2.11	1.90	3.4
Oct	28.51	.76	43.2	57.1	54.2	83	27	63.8	41.5	38	43	82	61	.78	.50	2.9
Nov	28.67	1.07	33.9	46.3	44.6	75	21	57.2	32.0	28	31	81	59	1.24	.82	2.8
Dec	28.66	.98	25.6	37.2	36.4	71	8	49.2	23.6	19	23	78	58	.06	.06	2.8
Means	28.56	.87	44.3	57.2	53.2	103	—14	65.0	41.4	38	41	80	58	17.63	......	3.5

CORPUS CHRISTI, TEX.

[Lat., 27° 49' N.; long., 97° 25' W.]

Jan	30.18	.84	61.6	66.2	64.0	80	32	69.7	58.2	59	62	90	86	3.84	2.48	7.3
Feb	30.02	.71	60.8	65.4	64.0	85	30	69.9	58.0	58	59	89	80	2.01	1.50	6.5
Mar	30.01	1.10	61.1	66.5	65.1	89	28	71.8	58.4	56	60	85	80	1.67	1.30	6.5
Apr	30.02	.52	67.0	71.2	68.6	80	50	73.1	64.2	64	66	88	83	1.36	.49	7.9
May	29.90	.44	74.8	77.9	75.7	91	58	80.3	71.1	70	70	85	78	2.40	1.28	6.3
June	29.99	.34	78.7	80.8	79.2	94	65	83.8	74.6	74	74	86	80	3.22	2.50	5.8
July	29.98	.33	79.7	83.4	81.3	92	70	87.1	75.5	75	76	87	78	.99	.54	6.0
Aug	29.99	.32	80.2	84.1	81.3	90	74	86.3	76.3	75	75	86	75	1.81	1.32	6.6
Sept	29.98	.36	75.1	81.5	78.4	90	55	84.6	72.1	70	71	85	72	1.07	.41	4.7
Oct	30.00	.61	68.5	75.2	72.3	90	50	79.2	65.4	64	66	86	75	2.47	.86	4.7
Nov	30.13	.51	59.0	66.9	63.5	81	42	70.9	56.1	54	59	84	77	.37	.25	4.6
Dec	30.18	.87	54.0	61.8	58.8	80	35	66.6	51.0	48	53	82	74	1.80	1.10	5.3
Means	30.03	.58	68.3	73.4	71.0	94	28	76.9	65.1	64	66	86	78	28.01	......	6.1

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

COLUMBUS, OHIO.

[H=837. T=94. h=76.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	7.6	44	W.	S.	8	2	3	2	28	5	9	5	0	6	10	15	18	4	16	0	0	0
Feb	7.8	30	SW.	S.	5	4	6	6	13	6	7	9	0	7	5	16	16	2	14	0	3	0
Mar	9.4	38	SW.	W.	8	5	5	5	11	4	14	10	0	4	9	18	19	6	17	0	1	0
Apr	7.2	52	W.	S.	6	12	5	5	15	8	4	5	0	12	6	12	12	0	5	0	3	0
May	5.5	42	W.	S.	5	3	4	8	15	8	5	12	2	8	11	12	17	0	0	0	8	0
June	4.9	52	NW	S.	2	9	7	2	15	13	6	5	1	10	16	4	15	0	0	7	12	0
July	5.2	36	W.	S.	5	8	6	10	19	7	1	4	2	24	4	3	7	0	0	7	4	0
Aug	4.6	28	W.	N.	12	11	3	5	12	6	6	6	1	12	9	10	8	0	0	3	7	0
Sept	5.0	22	NE.	S.	8	12	4	6	16	7	2	4	1	10	11	9	14	0	0	0	6	1
Oct	7.2	36	W.	S.	5	3	3	6	12	11	10	12	0	5	10	16	14	0	0	0	0	0
Nov	8.1	36	S.	S.	8	4	3	3	20	7	8	7	0	9	7	14	12	0	8	0	0	0
Dec	8.9	38	W.	S.	7	6	4	6	16	3	9	10	1	7	12	12	11	10	26	0	0	0
Means	6.8	....	......	S.	79	79	53	64	192	85	81	89	8	114	110	141	163	22	86	17	44	1

CONCORDIA, KANS.

[H=1,410. T=42. h=34.3.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	6.8	30	S.	S.	13	7	3	6	13	3	5	9	3	11	14	6	7	17	30	0	0	0
Feb	7.8	30	N.	N.	14	10	7	3	12	5	1	3	1	13	10	5	4	9	23	0	0	0
Mar	9.7	48	S.	N.	19	6	10	8	6	1	7	5	0	13	10	8	6	4	23	0	0	0
Apr	10.5	48	NW.	S.	9	9	7	8	10	5	4	7	1	15	6	9	6	0	1	3	2	0
May	9.7	38	S.	S.	16	5	6	4	18	2	3	7	1	14	17	0	7	0	1	0	6	0
June	9.6	30	S.	S.	5	1	7	11	21	2	6	5	2	13	17	0	8	0	0	10	5	0
July	8.1	30	S.	S.	7	2	11	13	22	3	1	1	2	22	8	1	5	0	0	26	4	0
Aug	6.9	36	NE.	SE	2	11	4	23	9	6	1	3	3	13	17	1	14	0	0	7	9	0
Sept	5.8	34	S.	S.	7	2	10	6	14	0	2	1	18	15	14	1	4	0	0	4	3	0
Oct	6.6	30	N.	S.	9	5	5	5	15	2	3	8	10	19	8	4	6	9	2	0	0	0
Nov	6.1	24	N.	SW.	15	3	1	0	5	17	11	4	4	18	9	3	4	0	15	0	0	0
Dec	6.4	28	N.	N.	15	4	2	4	10	9	8	2	8	20	6	5	2	2	26	0	0	0
Means	7.8	....	......	S.	131	65	73	91	155	55	52	55	53	186	136	43	73	32	121	50	29	0

CORPUS CHRISTI, TEX.

[H=20. T=42.8. h=33.9.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	12.7	38	N.	SE.	13	8	2	27	7	0	1	4	0	1	15	15	12	0	0	0	1	0
Feb	13.8	42	NW.	SE.	8	2	4	30	4	0	2	6	0	4	12	12	7	0	1	0	1	0
Mar	14.6	36	SE.	SE.	10	2	5	32	5	2	0	6	0	3	18	10	10	0	1	0	1	0
Apr	14.7	42	SE.	SE.	9	4	6	33	1	1	0	5	1	0	12	18	9	0	0	0	3	0
May	13.8	54	NW.	SE.	6	3	12	35	2	0	0	4	0	6	13	12	6	0	0	1	3	0
June	13.2	48	E.	SE.	4	1	5	48	1	0	0	1	0	5	17	8	6	0	0	1	2	0
July	11.0	35	SE.	SE.	0	1	0	56	2	1	1	1	0	6	19	6	7	0	0	3	2	0
Aug	11.1	25	SE.	SE.	4	0	2	56	0	0	0	0	0	0	23	8	6	0	0	0	1	0
Sept	10.5	34	SE.	SE.	6	2	9	26	3	5	2	6	1	11	11	8	8	0	0	0	0	0
Oct	11.1	36	N.	SE.	15	2	5	26	3	4	3	5	0	7	19	5	8	0	0	1	0	0
Nov	10.0	27	N.	SE.	13	9	3	16	2	2	2	11	2	13	8	9	5	0	0	0	0	0
Dec	10.3	29	N.	N.	18	5	6	16	7	0	2	6	2	11	9	11	4	0	0	0	0	0
Means	12.2	....	......	SE.	106	39	59	401	36	15	13	65	6	67	176	122	88	0	2	6	14	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

DAVENPORT, IOWA.

[Lat., 41° 30′ N.; long., 90° 38′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a. m.	Dew point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.51	1.80	22.9	28.0	26.6	54	— 7	34.6	18.6	17	22	80	77	2.49	1.16	5.6
Feb	29.41	.95	26.7	32.2	31.4	63	4	38.7	24.1	21	22	80	69	1.10	.43	5.9
Mar	29.43	1.19	24.2	32.8	30.0	61	— 8	38.3	21.6	18	22	77	65	2.24	.80	5.5
Apr	29.41	1.08	45.7	57.0	52.6	81	27	63.0	42.2	36	38	71	51	.86	.52	4.8
May	29.26	.70	52.2	62.1	58.0	90	33	68.0	47.9	48	45	72	56	2.33	2.08	5.4
June	29.29	.71	69.7	78.4	74.4	08	52	84.1	64.6	63	65	80	66	4.51	1.26	5.4
July	29.35	.44	70.0	81.0	76.2	97	55	86.5	65.9	59	58	68	48	.85	.61	3.4
Aug	29.40	.50	64.1	74.2	70.2	97	49	80.4	60.1	56	55	76	52	1.66	.68	3.9
Sept	29.45	.80	54.5	64.8	61.8	90	37	72.1	51.4	48	48	79	57	2.34	.98	4.1
Oct	29.31	.88	46.1	58.8	52.1	81	25	60.1	44.4	41	42	84	65	3.63	.84	5.8
Nov	29.44	.82	36.0	43.6	42.0	69	26	49.8	34.1	29	32	76	66	1.37	.52	4.7
Dec	29.47	.89	25.8	32.7	30.4	57	6	39.9	22.9	18	20	74	63	.62	.37	4.3
Means	29.39	.86	44.8	53.4	50.5	98	— 8	59.5	41.5	37	39	76	61	26.10	......	4.8

DENVER, COLO.

[Lat., 39° 45′ N.; long., 105° 0′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a. m.	Dew point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
Jan	24.66	.75	20.2	33.1	28.2	72	— 8	41.3	15.2	8	13	68	40	.18	.08	3.6
Feb	24.65	.99	24.2	38.1	34.0	77	— 8	46.8	21.1	13	14	68	43	.46	.28	5.4
Mar	24.68	.86	31.8	47.4	41.0	71	5	53.6	28.3	14	15	52	34	.35	.26	5.7
Apr	24.76	.53	39.4	55.3	48.0	77	20	60.0	36.0	24	22	60	38	2.50	1.28	5.6
May	24.71	.56	48.1	64.7	57.7	85	32	71.0	44.4	36	33	65	38	2.01	.27	5.5
June	24.74	.62	55.9	77.0	67.6	94	37	82.0	52.3	34	28	45	18	T.	T.	4.1
July	24.85	.40	62.0	81.3	74.8	97	54	89.1	60.5	48	42	50	30	.79	.58	6.5
Aug	24.86	.35	58.6	75.5	69.0	95	48	81.8	56.2	44	42	63	36	1.89	.62	5.4
Sept	24.85	.59	49.7	70.6	62.5	87	34	77.8	47.2	34	29	55	25	.17	.20	4.5
Oct	24.79	.68	38.8	56.4	49.4	75	25	63.6	35.3	23	22	57	33	.64	.52	3.1
Nov	24.90	.88	30.8	45.2	40.3	74	17	53.8	26.8	13	15	51	34	.30	.16	2.3
Dec	24.80	.80	30.7	43.4	39.3	70	14	53.4	25.2	11	10	47	30	.04	.03	3.6
Means	24.77	.67	40.9	57.3	51.0	97	— 8	64.6	37.4	25	.24	58	34	9.33	......	4.8

DES MOINES, IOWA.

[Lat., 41° 35′ N.; long., 93° 37′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a. m.	Dew point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
Jan	29.24	1.15	15.6	22.4	20.6	50	—18	30.3	11.0	10	14	79	73	2.62	1.35	3.9
Feb	29.14	1.01	21.9	28.9	26.9	59	— 5	35.1	18.7	16	17	79	63	1.17	.40	4.0
Mar	29.15	1.09	23.7	33.0	29.7	66	— 8	38.9	20.5	17	22	76	67	.91	.44	3.7
Apr	29.11	.98	45.5	59.1	52.8	83	25	63.4	42.3	36	38	71	48	.78	.38	3.4
May	28.96	.78	51.9	63.7	58.4	89	32	69.7	47.1	42	44	72	52	3.00	.75	4.6
June	29.00	.68	67.8	77.6	73.2	96	49	82.7	63.6	62	64	81	65	4.91	1.90	4.5
July	29.07	.46	70.1	82.2	76.9	101	55	87.3	66.5	60	59	71	47	1.10	.41	2.8
Aug	29.13	.48	62.2	73.8	69.6	97	48	80.5	58.7	55	56	79	56	3.35	1.20	3.5
Sept	29.17	.78	52.5	64.6	61.0	89	33	72.3	49.7	48	51	81	62	1.57	1.06	4.4
Oct	29.05	.85	43.5	53.7	51.5	79	22	60.9	42.1	39	41	81	65	4.48	1.63	4.6
Nov	29.17	.95	34.3	43.3	41.2	67	19	50.5	31.8	29	32	81	67	.74	.46	2.5
Dec	29.19	1.00	25.7	34.1	32.3	66	3	42.0	22.6	18	23	74	68	.11	.06	2.6
Means	29.12	.85	42.9	53.0	49.5	101	—18	59.5	39.6	36	38	78	61	24.74	......	3.8

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

DAVENPORT, IOWA.

[H—613. T—100.4. h—92.6.]

Months and year.	Wind.													Number of days.								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	7.2	48	SW.	NW.	2	4	4	6	1	13	9	16	7	9	12	10	9	12	24	0	0	0
Feb	7.5	32	NW.	NW.	6	2	4	6	3	10	5	13	7	7	9	12	10	8	21	0	0	0
Mar	7.0	36	E.	NW.	3	7	6	4	3	5	5	16	13	6	18	7	13	10	23	0	1	0
Apr	11.3	38	NW.	E.	2	11	17	7	2	11	2	7	1	12	14	4	8	0	3	0	3	0
May	9.8	38	SW.	SW.	1	8	5	4	10	11	9	9	5	9	13	9	17	0	0	0	5	0
June	5.3	54	SW.	SW.	1	3	11	7	1	13	1	8	15	12	8	10	17	0	0	7	7	0
July	7.4	30	SW.	NW.	4	9	7	6	8	8	2	10	8	14	13	4	7	0	0	11	2	0
Aug	5.5	26	NW.	E.	5	7	12	6	2	10	2	11	7	13	14	4	12	0	0	3	2	0
Sept	6.4	36	W.	NE.	5	11	9	7	2	8	1	6	11	12	12	6	9	0	0	0	3	0
Oct	7.4	38	NW.	NW.	5	7	9	5	3	6	5	14	8	6	14	11	12	0	2	0	2	0
Nov	8.0	30	W.	W.	3	5	6	2	1	9	12	11	11	13	7	10	8	0	18	0	...	0
Dec	9.6	38	SW.	NW.	2	9	8	1	2	13	6	17	4	14	6	11	6	21	25	0	1	0
Means	7.7	....	......	NW.	39	83	98	61	38	117	59	138	97	127	140	98	128	42	111	21	26	0

DENVER, COLO.

[H—5,281. T—86.4. h—79.4.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan	6.8	48	NW.	S.	7	14	2	4	20	5	6	3	1	16	11	4	4	9	29	0	0	0
Feb	7.9	48	N.	S.	7	9	3	2	22	4	5	3	1	8	12	8	7	4	24	0	0	0
Mar	8.2	36	N.	NW.	12	2	1	5	12	8	8	12	2	6	16	9	4	2	21	0	0	0
Apr	7.4	48	NW.	N.	13	8	3	6	9	8	4	6	3	8	13	9	9	0	11	0	0	0
May	7.0	36	N.	NE.	14	11	8	4	14	2	3	6	0	5	19	7	12	0	1	0	5	0
June	6.9	38	N.	S.	12	9	1	9	12	10	3	4	0	9	21	0	0	0	0	5	1	0
July	6.5	48	W.	SW.	6	4	4	4	12	22	3	7	0	1	21	9	8	0	0	15	7	0
Aug	6.2	35	NW.	NE.	14	7	9	1	10	12	2	7	0	9	12	10	10	0	0	8	7	0
Sept	6.1	36	W.	SW.	4	9	3	9	12	14	4	5	0	8	19	3	4	0	0	0	0	0
Oct	6.3	30	NE.	NE.	5	15	3	5	9	14	2	9	0	17	12	2	5	0	9	0	0	0
Nov	6.4	30	NE.	SW.	4	16	4	2	6	23	2	3	0	20	6	4	2	1	27	0	0	0
Dec	5.6	46	NE.	SW.	8	12	2	2	4	26	2	6	1	17	10	4	2	1	27	0	0	0
Means	6.8	....	......	SW.	106	115	43	53	142	148	44	71	8	124	172	69	67	17	149	23	20	0

DES MOINES, IOWA.

[H—869. T—84.2. h—75.4.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan	7.2	24	NW.	NW.	8	3	3	9	4	7	5	20	3	17	8	6	8	16	28	0	0	0
Feb	8.5	34	NW.	NW.	12	6	1	8	4	7	4	13	1	12	8	8	4	10	23	0	0	0
Mar	8.8	36	NE.	NW.	5	7	7	9	2	3	2	27	0	19	5	7	12	9	26	0	1	0
Apr	10.5	35	SW.	SE.	4	11	9	12	4	11	0	6	3	10	5	6	8	0	2	0	2	0
May	10.2	36	SW.	NW.	10	4	2	8	8	9	6	15	0	12	13	6	12	0	1	0	7	0
June	8.0	45	SW.	SW.	3	5	2	11	6	16	4	11	2	13	10	7	11	0	0	6	10	0
July	9.2	38	SW.	SW.	3	10	4	11	8	14	2	9	1	21	6	4	8	0	0	11	4	0
Aug	6.7	32	SW.	SE.	9	5	3	10	7	8	8	4	8	20	5	6	14	0	0	4	4	0
Sept	6.4	35	SW.	S.	3	8	5	5	9	6	6	6	12	13	9	8	7	0	0	0	2	0
Oct	7.6	32	N.	NW.	6	2	6	7	6	11	8	12	4	14	7	10	12	0	4	0	3	0
Nov	8.0	34	NW.	W.	7	1	3	3	3	14	19	10	0	21	7	2	4	1	15	0	0	0
Dec	8.7	36	SW.	NW.	4	7	4	5	4	11	9	15	3	21	6	4	3	8	26	0	0	0
Means	8.3	....	......	NW.	74	60	49	98	65	117	73	148	37	202	89	74	103	44	125	21	33	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

DETROIT, MICH.

[Lat., 42° 20′ N.; long., 83° 3′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.35	1.17	31.0	34.5	33.6	66	5	40.4	26.8	27	29	85	80	2.70	.95	7.2
Feb	29.26	1.01	30.0	33.2	32.4	63	12	38.4	26.3	26	26	85	77	2.01	.55	6.8
Mar	29.29	1.32	27.2	31.2	30.4	57	4	36.5	24.2	22	22	81	70	1.32	.47	6.8
Apr	29.33	1.21	41.8	48.7	46.5	74	25	56.1	36.9	35	37	77	65	2.74	.88	4.6
May	29.16	.76	51.3	55.6	54.6	84	32	62.8	46.6	44	44	76	68	3.94	1.50	5.7
June	29.22	.61	67.9	71.7	71.6	94	45	81.1	62.2	59	60	75	68	4.28	.99	5.3
July	29.24	.60	68.6	72.6	72.2	96	52	81.4	62.9	58	58	70	62	1.69	.94	3.5
Aug	29.29	.54	63.1	67.6	67.0	92	46	75.7	58.4	55	56	75	68	4.46	2.72	4.5
Sept	29.36	.63	56.3	60.4	59.8	85	39	67.8	51.9	51	51	81	72	2.31	.67	5.0
Oct	29.16	.99	48.2	51.5	51.6	74	29	58.0	45.2	44	44	84	76	5.67	1.29	7.7
Nov	29.26	.80	37.7	41.1	41.3	66	21	48.2	34.4	33	33	84	73	2.64	1.51	5.3
Dec	29.28	.98	24.6	28.1	27.3	48	10	32.8	21.8	20	21	85	74	1.23	.58	6.3
Means	29.26	.88	45.6	49.7	49.0	96	4	56.6	41.4	40	40	80	71	34.99	......	5.7

DODGE CITY, KANS.

[Lat., 37° 45′ N.; long., 100° 0′ W.]

Jan	27.46	.97	20.2	30.1	27.2	72	− 3	38.3	16.0	15	22	80	75	.42	.20	4.8
Feb	27.38	.95	22.6	35.6	32.4	78	− 6	45.0	19.8	16	21	76	63	.39	.28	5.0
Mar	27.37	1.04	30.6	48.9	42.5	77	11	56.7	28.3	22	23	74	40	.05	.02	4.8
Apr	27.39	.69	45.0	59.5	54.2	80	25	65.6	42.9	38	39	80	54	2.90	.94	5.2
May	27.30	.67	55.6	70.6	63.6	94	36	76.7	50.5	48	48	76	46	1.19	.98	3.8
June	27.33	.73	68.2	81.4	75.0	102	44	88.4	61.7	58	56	71	45	1.00	.35	4.6
July	27.38	.34	73.9	89.1	82.4	104	60	96.4	68.3	59	56	62	34	.22	.12	4.0
Aug	27.42	.46	66.9	81.2	76.4	102	54	89.3	63.4	60	58	80	49	3.45	1.55	4.5
Sept	27.45	.65	54.6	69.1	65.2	94	36	78.7	51.8	49	47	81	47	.57	.40	3.7
Oct	27.38	.77	43.4	58.3	55.5	86	28	70.2	40.8	36	36	76	47	.89	.63	3.5
Nov	27.53	.93	32.2	46.5	44.4	77	18	59.0	29.8	25	27	77	50	.50	.26	2.7
Dec	27.48	1.10	27.7	38.9	38.8	70	10	52.8	24.8	19	19	71	48	.14	.12	4.2
Means	27.41	.78	45.1	59.1	54.8	104	− 6	68.1	41.5	37	38	75	50	11.72	......	4.2

DUBUQUE, IOWA.

[Lat., 42° 30′ N.; long., 90° 44′ W.]

Jan	29.44	1.39	18.3	24.6	22.2	52	−16	30.0	14.5	14	20	83	83	2.31	1.12	5.4
Feb	29.35	.98	24.0	30.5	28.6	58	− 1	36.3	20.9	20	26	85	83	1.25	.47	6.5
Mar	29.39	1.06	21.8	31.5	27.9	59	−12	36.6	19.2	16	26	80	81	1.68	.46	5.2
Apr	29.36	1.07	45.1	55.7	51.2	78	26	61.3	41.2	39	46	80	71	2.94	1.06	4.3
May	29.19	.73	52.3	60.0	56.4	90	30	65.9	46.8	46	50	80	71	5.36	3.18	5.7
June	29.24	.79	69.0	76.6	73.6	96	52	82.7	64.4	64	69	84	79	9.59	3.04	5.8
July	29.30	.46	89.7	79.3	75.4	98	54	85.5	65.3	64	68	82	68	1.21	.62	4.4
Aug	29.35	.50	63.4	72.4	68.8	99	48	78.8	58.8	58	64	84	75	6.00	2.60	5.0
Sept	29.41	.90	52.4	62.5	59.8	90	32	70.4	49.3	48	56	87	79	3.72	1.69	4.7
Oct	29.25	.98	44.9	51.6	50.6	75	26	58.4	42.8	42	47	90	84	6.43	1.60	6.4
Nov	29.38	.84	34.5	41.4	39.8	60	24	47.4	32.3	30	36	84	80	1.85	1.18	5.2
Dec	29.40	.88	23.6	29.3	27.2	53	1	34.4	20.1	18	23	80	78	.82	.36	5.1
Means	29.34	.88	43.3	51.3	48.5	99	−16	57.8	39.6	38	44	83	78	43.16	......	5.3

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

DETROIT, MICH.

[H=724.45. T=157.92. h=144.50.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	12.1	48	SW.	SW.	2	1	4	4	10	17	19	5	0	2	12	17	12	6	22	0	0	0
Feb	11.1	38	NW.	SW.	6	5	10	2	6	12	5	11	0	5	8	15	10	7	22	0	1	0
Mar	11.4	49	NE.	NW.	7	8	4	5	5	7	14	12	0	4	13	14	11	9	24	0	1	0
Apr	10.2	37	SW.	N.	9	12	4	8	8	7	3	8	1	13	6	11	10	0	7	0	3	0
May	9.6	32	SW.	W.	2	9	9	8	7	4	14	8	1	9	11	11	13	0	0	0	0	0
June	7.5	60	NW.	SW.	3	11	9	8	9	9	4	7	0	7	16	7	10	0	0	1	7	0
July	8.2	30	W.	SW.	5	8	4	10	10	15	5	4	1	16	13	2	8	0	0	5	6	0
Aug	7.7	36	NW.	NW.	4	10	12	6	4	5	9	11	1	16	7	8	8	0	0	1	3	0
Sept	8.3	33	W.	S.	8	15	3	5	12	6	4	8	0	11	8	11	8	0	0	0	1	1
Oct	9.0	30	NW.	NW.	2	9	7	1	7	10	11	15	0	3	9	19	15	0	2	0	2	1
Nov	10.5	38	S.	SW.	4	7	0	1	10	18	8	11	1	13	5	12	7	0	8	0	0	0
Dec	11.3	51	SW.	SW.	7	7	1	3	7	23	4	10	0	5	12	14	8	16	29	0	0	0
Means.	9.7	...	......	SW.	58	102	67	61	95	132	100	110	5	104	120	141	115	38	114	7	28	2

DODGE CITY, KANS.

[H=2,523. T=44.5. h=37.24.]

Jan	9.9	48	S.	N.	14	6	0	6	14	1	7	9	5	12	11	8	5	12	28	0	0	0
Feb	10.8	48	N.	N.	15	7	1	8	7	4	3	10	1	9	12	7	5	9	26	0	0	0
Mar	12.4	62	N.	NE.	9	18	5	13	5	0	3	7	2	10	13	8	5	1	20	0	0	0
Apr	12.8	54	N.	S.	7	9	10	7	14	2	4	6	1	12	8	10	9	0	3	0	3	0
May	13.9	51	SW.	NE.	2	16	11	3	15	9	1	5	0	14	16	1	5	0	0	18	6	0
June	15.2	46	SW.	S.	3	6	4	8	23	9	1	4	2	11	13	6	8	0	0	18	6	0
July	11.6	42	SW.	S.	1	2	4	8	38	1	1	2	5	12	16	3	3	0	0	29	4	0
Aug	10.8	40	N.	S.	1	5	10	20	14	1	0	0	11	10	18	3	9	0	0	12	10	0
Sept	9.2	41	S.	S.	3	7	9	9	16	1	0	2	13	16	11	3	4	0	0	5	2	0
Oct	10.2	44	S.	N.	12	12	2	8	11	3	4	6	4	18	9	4	7	0	3	0	4	0
Nov	9.4	33	N.	N.	12	14	2	2	5	5	4	15	1	20	7	3	4	0	21	0	0	0
Dec	9.4	47	N.	N.	12	12	1	13	6	3	7	8	0	11	18	2	2	2	27	0	0	0
Means.	11.3	...	......	S.	91	114	59	105	108	39	35	74	45	155	152	58	66	24	128	65	33	0

DUBUQUE, IOWA.

[H=651. T=60. h=49.6.]

Jan	5.2	22	W.	W.	8	2	4	10	9	2	14	9	4	9	10	12	9	15	28	0	0	0
Feb	5.8	24	N.	NW.	6	1	5	10	7	4	7	11	5	6	7	15	13	8	24	0	0	0
Mar	6.4	40	W.	NW.	8	5	1	10	4	2	11	15	6	9	12	10	13	9	26	0	0	0
Apr	6.3	24	SW.	SE.	7	5	11	15	6	5	1	8	2	13	12	5	10	0	3	0	3	0
May	6.1	25	NW.	SE.	6	7	4	11	8	5	10	7	4	5	17	9	12	0	1	0	4	0
June	4.5	36	W.	SE.	5	1	3	15	9	11	9	4	3	9	8	13	15	0	0	6	10	0
July	5.0	30	NW.	NW.	7	1	7	10	5	8	6	12	6	10	17	4	6	0	0	9	2	0
Aug	4.0	21	NW.	SE.	6	2	2	20	6	4	3	13	6	10	12	9	13	0	0	3	1	0
Sept	3.7	22	NW.	NW.	7	2	5	11	7	3	1	14	10	11	12	7	9	0	0	1	4	0
Oct	3.5	30	W.	NW.	1	0	3	7	8	1	6	17	19	5	10	16	16	0	4	0	1	0
Nov	3.1	23	SW.	W.	2	2	3	1	4	2	13	10	23	10	8	12	6	0	15	0	0	0
Dec	2.9	25	W.	NW.	5	2	3	4	6	6	8	14	14	10	12	9	6	13	26	0	0	0
Means.	4.7	...	......	NW.	68	30	51	124	79	63	89	134	102	107	137	121	128	45	127	19	25	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

DULUTH, MINN.

[Lat., 46° 48′ N.; long., 92° 8′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a.m.	Temperature. 8 p.m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a.m.	Dew point. 8 p.m.	Relative humidity. 8 a.m.	Relative humidity. 8 p.m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	*In.*	*In.*	°	°	°	°	°	°	°	°	°	%	%	*In.*	*In.*	
Jan	29.36	1.23	8.5	15.1	12.2	44	—19	19.6	4.9	4	8	81	74	.87	.30	6.1
Feb	29.30	1.05	12.1	19.9	16.6	52	—13	25.0	8.3	7	10	79	68	1.09	.22	6.4
Mar ...	29.82	1.16	15.1	25.1	21.6	52	—11	29.7	13.4	8	12	73	61	1.16	.58	4.7
Apr......	29.35	1.02	36.8	42.4	40.6	68	17	48.2	32.0	27	28	70	60	1.75	.69	5.5
May	29.16	.79	40.2	44.8	43.2	76	29	50.0	36.5	33	32	77	64	2.24	.57	6.7
June ...	29.20	.63	55.2	60.7	57.5	91	41	65.9	49.1	40	49	82	71	3.33	1.39	5.9
July ...	29.23	.69	62.7	69.7	66.3	92	48	75.0	57.6	55	56	75	65	3.51	1.06	5.0
Aug	29.27	.61	57.7	62.3	60.7	86	45	67.5	53.9	51	53	78	73	3.62	1.13	5.4
Sept ...	29.31	.94	50.1	56.0	55.1	81	35	63.8	46.4	44	47	81	73	2.39	.85	4.7
Oct	29.18	1.16	42.0	45.5	45.0	66	24	49.9	40.1	36	37	81	73	3.03	1.72	6.8
Nov	29.28	.88	30.8	35.5	34.4	53	14	40.6	28.1	24	26	76	71	.91	.27	5.8
Dec	29.28	1.05	19.0	24.8	22.6	50	— 5	29.5	15.0	13	15	79	67	.19	.09	5.0
Means..	29.27	.93	35.8	41.8	39.6	92	—19	47.1	32.2	29	31	78	68	24.09	......	5.7

EASTPORT, ME.

[Lat., 44° 54′ N.; long., 66° 59′ W.]

Jan.....	30.03	1.59	19.6	23.9	20.6	52	—18	28.4	12.8	12	16	73	74	3.76	.99	6.0
Feb	29.99	1.53	21.9	23.9	23.4	48	— 2	30.4	16.3	15	16	76	73	4.58	1.38	5.4
Mar	29.83	1.38	28.0	30.8	29.4	46	10	34.2	24.5	20	25	74	80	5.85	.90	6.4
Apr	29.94	.94	37.2	38.6	39.2	64	24	45.7	32.6	24	27	63	66	1.95	.90	5.1
May....	29.91	.77	46.8	46.5	47.9	65	35	53.8	42.0	40	41	79	82	6.19	1.32	6.6
June ...	29.87	.66	52.6	52.7	54.0	71	44	60.5	47.4	45	46	77	80	2.77	1.08	7.5
July....	29.92	.79	59.8	59.4	60.8	82	48	69.4	52.2	53	54	80	82	1.97	.70	6.1
Aug....	29.90	1.01	60.4	59.7	61.4	80	52	67.8	55.1	55	56	83	88	5.35	1.54	6.9
Sept ...	30.02	.74	55.3	56.2	57.0	73	37	62.4	51.5	50	51	82	84	4.86	1.18	6.5
Oct	29.78	1.35	45.2	46.4	46.6	76	35	51.9	41.2	37	39	76	76	2.28	.65	6.4
Nov....	29.88	1.11	35.5	36.6	36.2	55	16	41.6	30.7	28	29	74	74	2.84	.75	7.3
Dec	29.86	1.49	17.2	17.8	17.6	52	—10	26.2	9.1	9	9	70	69	2.62	.63	6.0
Means .	29.91	1.11	40.0	41.0	41.2	82	—18	47.7	34.6	32	34	76	77	45.02	......	6.4

EL PASO, TEX.

[Lat., 31° 47′ N.; long., 106° 30′ W.]

Jan.....	26.26	.50	39.1	55.9	48.3	77	20	61.3	35.3	25	23	59	32	.72	.37	2.6
Feb	26.19	.67	40.5	62.3	51.8	82	19	66.7	37.0	16	14	38	16	.02	.02	1.1
Mar	26.18	.79	47.3	69.6	58.8	87	23	73.3	44.3	14	7	28	10	.01	.01	2.2
Apr	26.18	.49	53.7	75.4	64.3	88	34	77.8	50.8	25	16	37	13	.06	.06	2.9
May	26.10	.36	63.1	86.2	75.2	99	52	89.8	60.6	26	16	28	9	T.	T.	1.5
June ...	26.15	.39	68.6	90.2	79.6	101	54	93.8	65.4	31	26	33	14	.63	.37	2.3
July....	26.20	.31	72.6	90.5	82.3	100	62	94.9	69.7	53	48	53	25	.95	.64	4.4
Aug	26.22	.30	69.6	83.9	78.8	97	60	90.6	66.9	58	54	69	38	3.25	1.27	6.4
Sept....	26.23	.50	64.1	79.9	73.6	95	56	85.5	61.6	51	48	65	36	1.81	1.20	5.9
Oct	26.22	.47	51.6	70.5	63.2	87	35	77.8	48.6	34	30	54	26	.41	.20	3.4
Nov	26.33	.61	43.7	57.0	51.2	81	26	62.4	40.0	30	30	60	42	.35	.18	4.0
Dec	26.32	58	41.9	54.2	49.2	68	28	59.9	38.6	29	34	64	50	.28	.22	5.5
Means..	26.22	.50	54.6	73.0	64.7	101	19	77.8	51.6	33	29	49	26	8.49	......	3.5

Annual Meteorological Summary for the Year Ending December 31, 1890—Continued.

DULUTH, MINN.

[H=670. T=705. h=55.58.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	7.4	31	SW.	SW.	1	4	3	6	1	29	5	9	4	8	9	14	14	25	31	0	0	0
Feb	9.3	33	NE.	NW.	1	13	1	1	1	15	7	16	1	5	10	13	14	22	27	0	0	0
Mar m.	7.6	37	NW.	NW.	1	12	2	1	3	9	5	22	7	9	16	6	9	14	31	0	0	1
Apr	7.0	32	E.	NE.	3	19	9	2	0	6	2	7	12	8	14	8	9	0	11	0	1	0
May	6.9	27	SW.	NE.	2	30	7	0	0	1	5	12	5	5	13	13	17	0	5	0	2	0
June	5.2	34	NW.	NE.	1	27	7	0	0	4	7	6	8	6	13	11	13	0	0	1	2	0
July	6.6	36	NW.	NW.	2	9	0	0	8	3	9	13	9	10	14	7	12	0	0	3	8	0
Aug	5.9	24	NW.	NW.	3	18	1	5	2	4	5	17	7	9	14	8	18	0	0	0	5	0
Sept	7.5	34	NE.	NE.	7	13	3	5	3	9	11	6	3	13	7	10	12	0	0	0	5	0
Oct	6.6	25	NE.	NE.	6	16	2	3	0	12	7	12	4	4	16	11	12	0	3	0	0	0
Nov	7.1	26	NE.	SW.	6	5	2	1	2	14	12	15	3	6	12	12	9	7	21	0	0	0
Dec	7.0	34	W.	NW.	4	4	1	2	1	10	14	20	6	9	18	4	6	19	29	0	0	0
Means.	7.0	....	......	NE.	37	170	47	26	21	116	89	155	69	92	156	117	145	87	158	4	23	1

EASTPORT, ME.

[H=53. T=51. h=43.]

Jan	13.2	45	NW.	NW.	9	7	2	3	2	6	10	22	1	10	5	16	18	18	29	0	0	1
Feb	14.3	46	SE.	NW.	5	8	5	8	4	7	3	16	0	9	9	10	16	14	25	0	0	1
Mar	10.7	46	E.	NW.	9	6	3	5	3	6	9	19	2	9	7	15	20	11	22	0	0	0
Apr	10.2	38	E.	SW.	8	9	4	1	2	15	6	13	2	12	11	7	10	0	11	0	0	1
May	9.8	38	E.	S.	12	4	8	3	18	12	3	1	1	7	8	16	17	0	0	0	0	0
June	8.4	32	NW.	N.	15	6	0	3	7	11	4	3	2	3	12	15	14	0	0	0	2	0
July	5.8	20	E.	S.	4	3	1	1	20	17	5	6	5	6	14	11	12	0	0	0	2	0
Aug	7.6	88	SE.	S.	6	6	4	3	16	13	8	4	2	6	8	17	14	0	0	0	0	1
Sept	7.5	24	W.	SW.	12	4	3	2	6	12	10	6	5	8	7	15	12	0	0	0	0	2
Oct	12.0	44	NE.	NE.	10	19	3	3	1	11	8	6	1	8	6	17	14	0	0	0	0	2
Nov	10.3	38	SE.	SW.	9	3	0	2	4	15	14	13	0	4	10	16	14	5	16	0	0	1
Dec	14.7	54	SE.	NW.	3	5	1	7	2	3	10	30	1	8	10	13	13	19	31	0	0	0
Means.	10.4	....	......	NW.	102	80	43	41	85	128	90	130	22	90	107	168	174	67	134	0	4	9

EL PASO, TEX.

[H=3,706. T=69. h=62.5.]

Jan	6.2	38	W.	NW.	11	8	12	1	0	0	0	26	4	21	6	4	5	0	10	0	0	0
Feb	8.9	43	NW.	NW.	12	3	2	2	0	1	9	22	5	22	6	0	1	0	9	0	0	0
Mar	9.9	47	W.	NW.	6	3	8	2	0	2	4	34	3	23	7	1	1	0	6	0	0	0
Apr	8.3	37	W.	NW.	3	5	10	2	2	1	12	24	1	19	9	2	1	0	0	0	0	0
May	8.0	44	W.	NW.	5	8	12	1	2	0	7	22	5	27	4	0	0	0	0	15	0	0
June	7.3	44	NW.	E.	6	7	16	1	1	1	8	14	6	19	10	1	4	0	0	24	2	0
July	5.7	36	N.	E.	4	12	13	3	0	0	1	10	10	14	9	8	8	0	0	26	1	0
Aug	5.9	45	NW.	E.	4	13	19	3	3	0	1	4	15	4	16	11	16	0	0	18	7	0
Sept	4.5	46	NE.	E.	1	8	10	0	0	0	0	8	21	7	10	13	9	0	0	5	2	0
Oct	4.0	43	NW.	NW.	1	3	5	0	0	0	3	13	37	17	7	7	5	0	0	0	0	0
Nov	7.7	54	SW.	NE.	6	19	6	2	0	0	2	10	15	16	6	8	6	0	5	0	0	0
Dec	7.7	48	NW.	NW.	11	12	11	0	0	2	2	16	8	11	9	11	8	0	6	0	0	0
Means.	7.0	....	......	NW.	70	101	133	17	8	7	49	203	142	200	99	66	59	0	36	88	12	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

ERIE, PA.

[Lat., 42° 7′ N.; long., 80° 5′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.36	1.26	35.2	37.2	37.6	68	13	46.7	28.6	30	31	81	80	4.50	.84	8.4
Feb	29.27	.90	32.9	34.3	35.2	67	14	43.4	27.1	28	29	84	83	3.60	1.29	7.6
Mar	29.26	1.34	29.2	31.4	30.8	62	2	37.6	24.1	24	24	82	77	3.43	1.00	7.4
Apr	29.33	1.15	44.4	46.6	45.4	76	22	53.6	37.3	33	36	68	69	3.16	1.20	5.1
May	29.17	.69	52.6	54.8	53.2	79	34	61.7	44.8	46	48	80	80	6.40	1.25	6.5
June	29.22	.62	67.9	69.2	68.2	85	46	75.2	61.1	59	61	75	77	4.23	1.92	6.1
July	29.24	.61	69.8	71.1	70.6	94	50	78.0	63.2	59	60	70	70	.76	.29	4.9
Aug	29.27	.49	66.4	67.1	66.6	89	47	73.1	60.2	58	58	74	72	4.64	2.57	5.8
Sept	29.35	.56	59.0	61.2	60.8	87	39	67.7	53.9	52	54	79	78	5.16	1.96	5.6
Oct	29.14	.98	49.3	51.3	51.4	73	32	56.7	46.0	44	45	83	80	6.18	.80	7.4
Nov	29.25	.84	40.3	42.5	42.0	66	26	48.3	35.7	33	33	75	71	3.32	1.14	7.0
Dec	29.26	1.00	27.3	29.4	28.8	51	9	35.5	22.0	20	22	77	75	1.72	.56	8.2
Means	29.26	.87	47.9	49.7	49.2	94	2	56.5	42.0	40	42	77	76	47.05	......	6.7

EUREKA, CAL.

[Lat., 40° 48′ N.; long., 124° 11′ W.]

Jan	29.97	.73	39.5	44.6	42.2	54	28	48.0	36.3	36	39	89	80	18.26	3.72	7.6
Feb	30.01	.91	41.4	47.6	44.4	59	27	50.2	38.6	38	39	88	75	13.88	4.91	6.8
Mar	30.02	.97	42.9	50.9	46.9	60	31	53.7	40.1	40	42	89	72	11.57	2.90	6.4
Apr	30.06	.71	46.0	51.0	49.0	63	35	53.8	44.2	43	45	91	80	2.26	1.37	7.3
May	29.98	.58	50.8	56.1	54.0	78	41	59.3	48.8	49	49	93	78	1.71	.83	6.4
June	30.04	.37	51.9	57.5	55.2	65	45	60.0	50.5	49	51	92	79	.87	.35	5.8
July	30.03	.24	53.3	58.6	56.7	65	48	61.1	52.3	52	53	94	83	.08	.06	5.9
Aug	29.97	.35	52.7	57.8	55.8	65	45	60.1	51.5	52	54	96	86	.02	.01	6.5
Sept	29.93	.33	50.2	54.4	53.2	69	46	57.3	49.1	50	52	98	92	.79	.68	8.0
Oct	30.03	.39	47.2	53.8	51.6	70	38	58.2	45.0	46	51	94	90	.44	.41	4.7
Nov	30.09	.61	45.9	52.7	50.0	66	35	56.6	43.5	44	49	94	88	.18	.08	4.4
Dec	30.04	1.29	44.8	51.6	48.4	66	36	54.4	42.3	42	48	92	88	5.48	2.21	5.7
Means	30.01	.62	47.2	53.0	50.6	78	27	56.1	45.2	45	48	92	83	55.54	......	6.3

FORT ASSINNIBOINE, MONT.

[Lat., 48° 32′ N.; long., 109° 42′ W.]

Jan	27.11	1.15	−3.1	2.0	−5.1	46	−39	4.7	−14.9	−11	−5	77	73	.46	.24	4.8
Feb	27.16	1.14	−1.2	4.9	2.8	50	−40	13.0	−7.5	−10	−2	74	78	.68	.17	5.3
Mar	27.08	1.16	21.0	32.3	27.6	52	−7	36.6	18.5	16	22	82	67	.11	.04	6.3
Apr	27.16	.81	34.5	54.3	44.8	79	17	58.2	31.4	21	22	61	31	.08	.08	5.7
May	27.10	.88	44.1	62.0	52.6	80	30	65.8	49.4	35	30	72	35	.78	.31	5.9
June	27.11	.72	53.3	70.2	62.2	96	40	74.9	49.6	44	40	73	39	2.05	.53	6.2
July	27.15	.56	60.1	81.3	70.6	99	44	84.9	56.3	42	37	55	24	.58	.16	4.2
Aug	27.18	.55	53.3	74.7	64.8	94	40	78.3	51.3	43	40	70	33	1.26	.51	4.0
Sept	27.20	.59	44.4	62.0	55.6	87	26	68.8	42.5	38	38	80	46	1.87	.57	5.1
Oct	27.13	.77	38.1	48.0	45.6	71	22	56.7	34.5	30	32	75	56	1.47	.62	6.8
Nov	27.25	.71	34.4	42.3	40.6	68	9	51.9	29.2	23	25	66	55	.17	.14	4.7
Dec	27.13	.93	26.6	32.0	29.8	56	−12	39.1	20.6	18	19	72	62	.25	.10	5.8
Means	27.15	.83	33.8	47.2	41.0	99	−40	52.7	29.2	24	25	71	50	9.76	......	5.4

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

ERIE, PA.

[H=714. T=92. h=82.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	15.9	48	W.	S.	0	2	3	2	18	17	13	7	0	3	4	24	22	2	20	0	1	0
Feb	13.9	60	SE.	S.	3	5	5	7	11	8	11	6	0	5	5	18	17	2	22	0	1	0
Mar	13.6	37	NW.	W.	2	4	5	5	12	9	15	10	0	3	9	19	21	7	25	0	1	0
Apr	11.6	40	W.	NE.	1	14	5	2	11	13	8	6	0	11	8	11	13	0	3	0	3	0
May	10.2	37	NE.	W.	6	10	5	4	9	11	14	4	0	5	9	17	20	0	0	0	6	0
June	8.0	35	S.	S.	7	8	2	1	13	10	13	5	1	8	8	14	9	0	0	0	8	0
July	9.6	30	SW.	S.	6	10	1	3	15	9	12	6	0	12	12	7	8	0	0	1	5	0
Aug	9.0	30	SW.	W.	4	11	2	2	9	9	13	11	1	7	12	12	12	0	0	0	3	0
Sept	9.8	26	W.	S.	4	7	8	5	17	9	6	4	0	8	11	11	13	0	0	0	4	0
Oct	10.2	36	S.	SW.	9	5	7	5	11	14	3	7	1	4	6	21	22	0	0	0	2	1
Nov	12.8	37	SW.	SW.	5	2	6	1	12	16	4	14	0	5	8	17	13	1	10	0	0	0
Dec	14.3	42	NW.	SW.	5	3	6	5	13	13	7	10	0	3	4	24	18	11	29	0	0	0
Means	11.5	....	......	S.	52	81	55	42	151	138	119	89	3	74	96	195	188	23	109	1	34	1

EUREKA, CAL,

[H=64. T=60. h=52.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan	7.7	36	NW.	SE.	10	1	0	24	15	7	1	2	2	3	7	21	25	0	9	0	0	0
Feb	7.4	35	N.	N.	17	2	1	13	11	4	1	4	3	5	9	14	19	0	2	0	0	0
Mar	6.3	35	SW.	SE.	11	1	1	14	9	10	5	7	4	5	13	13	19	0	1	0	0	0
Apr	8.3	42	N.	N.	28	0	1	6	4	7	0	7	7	5	6	19	7	0	0	0	0	0
May	7.8	35	N.	NW.	15	1	0	5	7	7	3	20	4	5	14	12	7	0	0	0	0	0
June	8.6	35	N.	NW.	12	2	0	6	1	7	3	28	1	8	12	10	9	0	0	0	0	0
July	6.9	25	N.	NW.	18	0	0	2	5	6	1	26	4	6	13	12	2	0	0	0	0	0
Aug	5.3	25	N.	NW.	8	0	1	2	1	12	5	28	5	5	12	14	2	0	0	0	0	0
Sept	3.9	34	NW.	NW.	9	1	0	3	2	13	8	17	7	4	4	22	4	0	0	0	0	0
Oct	5.1	35	N.	N.	17	0	0	8	2	10	2	12	11	11	14	6	3	0	0	0	0	0
Nov	4.0	36	N.	N.	13	8	2	11	3	8	1	6	8	15	5	10	4	0	0	0	0	0
Dec	4.5	37	S.	SE.	11	4	4	17	8	4	0	5	8	8	12	11	14	0	0	0	0	0
Means	6.3	....	......	N.	169	21	10	111	68	95	30	162	64	80	121	164	115	0	12	0	0	0

FORT ASSINNIBOINE, MONT.

[H=2,690. T=16.5. h=2.3.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan*	10.0	48	SW.	SW.	1	3	2	0	2	22	4	5	5	10	6	7	7	23	30	0	0	0
Feb	11.3	48	SW.	SW.	5	10	0	2	0	23	0	11	5	8	11	9	9	20	28	0	0	0
Mar	10.1	48	NW.	NE.	2	11	9	0	4	10	8	6	12	7	10	14	5	9	28	0	0	0
Apr	13.9	63	W.	NW.	7	4	8	4	4	14	5	14	0	7	10	13	1	0	15	0	0	0
May	12.2	46	NW.	NW.	3	6	8	5	5	11	10	14	0	6	13	12	8	0	1	0	0	0
June	11.6	76	NW.	SW.	3	4	5	1	2	26	9	10	0	7	10	13	11	0	0	2	3	0
July	11.9	45	W.	SW.	2	4	7	7	1	17	13	11	0	14	10	7	8	0	0	11	4	0
Aug	10.4	43	W.	NW.	6	3	10	3	4	10	8	17	1	15	7	9	9	0	0	3	0	0
Sept	10.2	36	N.	SW.	4	6	3	3	7	18	9	10	0	13	6	11	8	0	2	0	1	0
Oct	13.2	48	SW.	SW.	4	3	4	3	4	26	14	3	1	6	7	18	8	0	11	0	0	0
Nov	15.7	52	SW.	SW.	1	2	4	2	2	41	6	2	0	14	7	9	2	2	18	0	0	2
Dec	16.0	72	SW.	SW.	3	6	4	1	3	36	4	3	2	9	7	15	5	9	26	0	0	0
Means	12.2	....	......	SW.	41	62	64	31	38	254	90	106	26	116	104	137	81	63	159	16	8	2

*Observations missed on the 9th.

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

FORT BUFORD, N. DAK.

[Lat., 48° N.; long., 103° 56′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	28.03	1.22	-7.7	-1.1	-4.2	42	-37	6.3	-14.6	-10	-6	90	81	.22	.06	4.8
Feb	28.00	1.11	-3.9	5.0	0.9	49	-43	13.0	-11.2	-7	1	80	82	.18	.05	5.5
Mar	27.94	1.26	16.6	27.3	22.4	51	-18	32.1	12.7	14	19	88	72	.58	.25	6.2
Apr	27.97	1.04	33.6	53.4	43.6	82	20	56.7	30.6	26	24	77	37	.60	.32	5.7
May	27.87	1.12	43.8	57.9	50.8	83	24	62.5	39.1	33	32	68	42	1.58	.45	6.3
June	27.86	0.71	58.3	72.3	65.1	88	42	77.0	53.2	52	52	81	53	5.23	3.50	6.7
July	27.92	0.69	61.9	81.5	71.4	100	44	86.0	56.8	52	49	71	36	1.06	.54	4.9
Aug	27.94	0.63	55.2	76.1	66.2	98	36	81.2	51.1	44	41	70	30	.22	.13	4.7
Sept	27.98	0.65	44.9	62.6	55.4	91	29	69.0	41.8	40	40	84	48	2.05	1.04	5.3
Oct	27.88	0.76	37.4	46.3	44.4	80	25	54.8	34.1	32	34	82	66	2.45	1.11	6.8
Nov	28.02	0.93	27.5	38.2	35.8	65	9	48.0	23.5	23	23	83	57	.03	.03	4.3
Dec	27.96	0.99	22.0	28.1	26.0	56	-2	36.5	15.4	15	15	75	61	.04	.03	5.0
Means	27.95	0.93	32.5	45.6	39.8	100	-43	51.9	27.7	26	27	80	55	14.24	......	5.5

FORT CANBY, WASH.

[Lat., 46° 16′ N.; long., 124° 4′ W.]

Months and year.	Pressure Mean.	Absolute range.	Temp. 8 a. m.	Temp. 8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean Maximum.	Mean Minimum.	Dew point 8 a. m.	Dew point 8 p. m.	Rel. hum. 8 a. m.	Rel. hum. 8 p. m.	Precip. Total.	Max. in 24 hours.	Mean cloudiness.
Jan	29.65	1.17	35.7	37.4	36.0	49	22	40.0	32.0	33	34	90	88	12.07	2.06	7.3
Feb	29.76	1.20	37.4	41.2	38.8	52	17	43.5	34.2	31	33	80	74	7.37	1.85	6.8
Mar	29.80	1.19	42.5	46.3	44.0	58	34	48.5	39.4	38	39	84	77	7.23	1.42	7.9
Apr	29.91	0.90	44.7	48.8	47.0	61	35	52.2	41.8	40	40	81	73	3.67	0.98	6.0
May	29.87	0.76	51.2	55.8	54.0	73	44	59.4	48.6	47	48	87	75	1.76	0.49	6.4
June	29.87	0.60	53.1	57.3	55.8	70	48	60.7	51.0	50	52	92	82	3.46	0.66	6.7
July	29.90	0.45	55.2	59.7	57.8	65	51	62.4	53.3	54	55	95	84	1.45	0.55	6.3
Aug	29.89	0.42	55.8	59.9	58.6	85	50	63.7	53.4	55	56	96	88	2.53	1.78	6.9
Sept	29.87	0.35	52.7	56.8	55.4	72	46	60.9	50.0	51	52	95	85	0.34	0.15	5.2
Oct	29.88	0.66	50.1	53.3	52.4	69	44	57.0	47.7	49	50	96	89	5.32	1.70	6.3
Nov	29.98	0.75	49.4	52.2	51.0	72	39	55.7	46.3	47	48	93	88	1.77	0.44	5.7
Dec	29.78	1.25	46.2	47.6	46.5	56	38	50.7	42.3	45	46	98	94	6.98	1.03	7.8
Means	29.85	0.81	47.8	51.4	49.8	85	17	54.6	45.0	45	46	91	83	53.95	......	6.6

FORT CUSTER, MONT.

[Lat., 45° 42′ N.; long., 107° 34′ W.]

Months and year.	Pressure Mean.	Absolute range.	Temp. 8 a. m.	Temp. 8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean Maximum.	Mean Minimum.	Dew point 8 a. m.	Dew point 8 p. m.	Rel. hum. 8 a. m.	Rel. hum. 8 p. m.	Precip. Total.	Max. in 24 hours.	Mean cloudiness.
Jan	26.83	1.02	-1.1	8.3	4.8	45	-32	16.0	-6.5	-4	4	88	84	0.31	0.14	3.6
Feb	26.80	1.06	11.2	21.6	17.6	64	-34	28.8	6.3	8	16	88	82	0.24	0.12	6.1
Mar	26.76	1.04	28.2	39.9	35.4	65	-4	45.2	25.6	25	34	89	80	1.18	0.62	6.6
Apr	26.82	0.78	34.6	57.3	45.4	80	17	60.4	30.4	30	38	84	53	0.56	0.28	5.0
May	26.74	1.00	46.6	64.5	55.4	88	30	68.5	42.2	37	36	72	38	1.03	0.30	6.0
June	26.77	0.60	53.3	72.2	63.0	91	40	75.8	50.2	47	47	79	44	2.44	0.68	5.6
July	26.80	0.58	61.8	86.7	74.2	100	48	90.1	58.4	45	44	56	24	0.06	0.06	2.3
Aug	26.83	0.60	56.9	81.1	68.6	96	39	84.3	52.8	42	43	61	28	0.31	0.26	3.4
Sept	26.86	0.69	43.9	68.2	58.4	88	29	74.5	42.3	37	37	78	35	1.72	1.02	3.2
Oct	26.82	0.74	38.6	52.5	48.4	74	24	60.6	36.1	30	31	74	47	0.98	0.50	5.7
Nov	26.95	0.91	30.5	44.9	39.9	74	10	53.0	26.8	23	27	77	54	0.48	0.23	3.7
Dec	26.84	0.76	25.0	34.5	31.4	58	-7	40.9	22.0	18	20	76	61	0.35	0.16	5.0
Means	26.82	0.82	35.8	52.6	45.2	100	-34	58.2	32.2	28	31	77	52	9.66	......	4.7

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

FORT BUFORD, N. DAK.

[H=1,900. T=16.8. h=2.6.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	6.5	36	W.	NW.	8	2	12	0	8	5	12	14	1	11	12	8	6	26	31	0	0	8
Feb	9.5	72	NW.	NW.	7	8	4	3	4	6	5	17	2	6	12	10	7	23	28	0	0	0
Mar	10.2	60	NW.	E.	5	9	15	5	5	1	10	12	0	3	18	10	8	15	30	0	0	1
Apr	9.7	44	NW.	E.	11	7	14	5	3	4	7	8	1	5	16	9	5	0	20	0	1	0
May	12.4	54	NW.	NW.	7	9	9	7	3	2	5	20	0	4	12	15	13	0	5	0	3	0
June	9.6	56	NW.	E.	5	6	10	7	5	7	9	10	1	3	15	12	16	0	0	0	9	0
July	9.1	40	NW.	SE.	8	5	8	13	3	3	12	10	0	10	17	4	9	0	0	11	10	2
Aug	9.5	46	N.	NW.	7	6	13	4	2	5	8	17	0	11	16	4	4	0	0	5	4	0
Sept	8.5	31	NW.	E.	6	9	12	3	2	4	10	12	2	6	16	8	13	0	3	1	2	2
Oct	10.0	60	W.	NW.	2	5	7	4	5	5	7	27	0	2	15	14	12	0	13	0	1	1
Nov	8.2	42	NW.	NW.	3	1	4	1	14	13	4	20	0	13	12	5	1	3	28	0	0	4
Dec	9.1	60	NW.	NW.	3	2	9	1	11	15	4	16	1	11	12	8	3	10	31	0	0	0
Means.	9.4	....	......	NW.	72	69	117	53	65	70	93	183	8	85	173	107	97	77	189	17	30	13

FORT CANBY, WASH.

[H=179. T=10.4. h=2.3.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan	18.1	87	S.	SE.	2	5	3	30	11	4	3	4	0	5	7	19	25	4	13	0	1	0
Feb	15.2	70	S.	SE.	0	4	12	16	7	3	10	3	1	5	8	15	19	1	9	0	0	0
Mar	14.2	68	SE.	SE.	5	2	8	21	12	4	7	3	0	1	8	22	25	0	0	0	0	0
Apr	9.5	70	SE.	N.	15	0	1	10	5	2	12	6	9	7	11	12	15	0	0	0	0	0
May	9.8	48	SE.	N.	16	0	0	8	2	6	11	12	7	5	10	16	12	0	0	0	0	0
June	11.6	48	SE.	W.	10	0	1	9	11	6	13	8	2	6	9	15	21	0	0	0	0	0
July	8.6	48	S.	N.	24	1	1	2	9	8	6	6	5	4	17	10	11	0	0	0	0	0
Aug	7.9	42	S.	N.	27	0	0	4	9	8	3	10	1	0	18	13	14	0	0	0	0	0
Sept	8.1	30	S.	N.	37	2	0	3	4	5	2	5	2	9	14	7	6	0	0	0	0	0
Oct	12.5	72	SE.	N.	13	3	9	8	10	8	6	5	0	5	12	14	20	0	0	0	1	0
Nov	8.8	36	SE.	N.	19	0	14	12	10	1	0	3	1	6	15	11	15	0	0	0	0	0
Dec	20.6	84	SW.	SE.	3	1	12	19	17	7	0	1	2	0	12	19	23	0	0	0	0	0
Means.	12.1	....	......	N.	171	18	61	142	107	62	73	66	30	53	139	173	206	5	22	0	2	0

FORT CUSTER, MONT.

[H=3,040. T=18. h=26.5.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan	5.8	40	N.	SE.	10	1	4	22	6	10	6	0	3	12	16	3	8	19	31	0	0	1
Feb	9.1	52	SW.	N.	14	6	3	9	4	11	3	6	0	6	10	12	6	14	27	0	0	0
Mar	8.4	47	NW.	SE.	6	9	5	17	2	8	2	12	1	5	14	12	10	3	25	0	1	0
Apr	8.6	42	NW.	SE.	4	6	0	14	3	11	2	11	0	7	17	6	7	0	20	0	0	2
May	9.6	48	N.	NW.	7	12	3	13	0	8	5	13	1	7	14	10	13	0	2	0	1	0
June	7.8	44	NW.	NW.	13	4	2	13	0	9	3	15	1	10	8	12	12	0	0	3	4	0
July	7.3	36	N.	SW.	11	11	4	4	3	18	2	7	2	20	10	1	1	0	0	18	1	0
Aug	7.1	33	N.	SE.	11	9	2	15	4	9	3	9	0	16	10	5	3	0	0	8	0	0
Sept	6.3	37	N.	SE.	11	11	2	23	1	5	2	4	1	15	12	3	5	0	2	0	1	0
Oct	7.7	41	N.	SW.	6	6	1	16	5	17	6	5	0	9	8	14	7	0	11	0	0	0
Nov	6.6	31	NW.	SE.	2	3	3	21	2	19	6	3	1	16	6	8	3	1	24	0	0	0
Dec	6.9	40	NW.	SE.	7	5	2	24	2	11	4	7	0	11	8	12	3	7	24	0	0	0
Means.	7.6	....	......	SE.	102	83	40	191	32	136	44	92	10	134	133	98	78	44	166	29	8	3

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

FORT DU CHESNE, UTAH.

[Lat., 40° 35′ N.; long., 109° 50′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew point. 8 a. m.	Dew point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	25.05	.90	1.8	13.0	11.6	40	-22	22.8	.4	-3	6	70	74	1.02	.40	5.9
Feb	24.98	1.09	21.7	31.2	29.9	49	2	39.1	20.7	16	21	79	66	.44	.34	3.6
Mar	25.03	.88	25.2	41.9	37.8	63	8	51.1	24.6	18	16	72	39	.00	.00	4.0
Apr	25.03	.70	35.5	57.8	49.2	78	21	64.5	33.8	24	26	63	32	.41	.41	4.7
May	24.97	.54	47.2	70.9	60.2	86	30	77.7	42.8	29	22	50	17	.00	.00	4.0
June	......	.53	......	76.6	62.3	92	33	82.3	42.3	....	27	.....	17	.00	.00	3.4
July	......	.31	......	87.8	74.6	100	46	93.6	55.6	....	36	.....	19	.86	.69	4.2
Aug	25.09	.29	55.2	80.1	69.5	98	43	87.7	51.3	45	38	68	28	.67	.43	4.3
Sept	25.10	.60	45.5	72.4	61.4	88	30	80.8	42.1	33	33	63	27	.48	.30	4.5
Oct	25.10	.67	31.7	51.6	45.1	69	22	60.4	29.8	24	26	74	39	1.36	.74	3.4
Nov	25.23	.81	22.1	38.6	34.8	64	12	48.9	20.8	16	24	76	57	.33	.33	3.6
Dec	25.21	.92	17.0	29.4	26.8	49	8	37.8	15.8	12	22	82	75	.38	.23	5.2
Means	25.07	.68	......	54.3	46.9	100	-22	62.2	31.7	....	25	.....	41	5.95	......	4.2

FORT ELLIOTT, TEX.

[Lat., 35° 30′ N.; long., 100° 21′ W.]

Jan	27.31	.88	32.2	40.4	39.0	83	12	49.8	28.1	26	31	79	72	2.40	1.11	4.9
Feb	27.23	.80	30.4	44.1	40.6	78	2	53.7	27.4	23	22	74	48	.01	.01	4.7
Mar	27.23	.92	37.2	54.2	47.4	87	14	60.4	34.5	30	22	74	35	.02	.01	5.4
Apr	27.36	.61	49.9	60.6	53.4	90	28	67.3	45.5	39	41	73	56	3.94	1.15	5.9
May	27.17	.56	58.1	71.4	65.4	90	36	77.5	53.2	51	48	79	46	1.69	.41	4.3
June	27.22	.61	67.5	81.5	74.4	97	50	86.7	62.0	58	54	74	42	1.71	1.45	2.9
July	27.27	.31	72.2	87.4	80.4	100	59	93.3	67.4	59	54	65	31	.88	.63	3.9
Aug	27.30	.44	68.3	82.4	76.4	100	55	89.1	63.7	60	57	78	45	2.89	1.38	4.6
Sept.*	27.32	.58	56.6	70.5	66.4	91	35	79.4	53.5	50	47	81	45	.05	.02	3.2
Oct	......	......	......	......	......	....	....	.....	.....	....	....	....	....	.....	.....	....
Nov	......	......	......	......	......	....	....	.....	.....	....	....	....	....	.....	.....	....
Dec	......	......	......	......	......	....	....	.....	.....	....	....	....	....	.....	.....	....
Means	......	......	......	......	......	....	....	.....	.....	....	....	....	....	.....	.....	....

*Station closed September 30.

FORT GRANT, ARIZ.

[Lat., 32° 39′ N.; long., 109° 57′ W.]

Jan	25.23	.44	38.8	48.1	45.4	73	19	51.7	36.0	26	28	61	48	1.58	1.21	2.5
Feb	25.20	.47	41.0	52.7	48.4	71	22	58.7	38.2	22	23	50	34	.46	.26	2.0
Mar	25.21	.56	46.5	59.0	53.8	76	24	64.5	43.1	26	23	45	25	.46	.42	3.5
Apr	25.20	.41	51.6	68.1	59.0	79	31	70.2	47.8	32	35	48	32	.92	.60	4.2
May	25.16	.30	60.0	77.6	*69.6	92	50	81.5	57.8	28	24	29	13	.01	.01	1.2
June	25.20	.19	61.8	82.5	74.6	92	54	86.6	62.5	27	26	24	14	.20	.08	2.7
July	25.25	.21	68.7	82.5	78.0	96	60	89.4	66.5	56	52	61	36	3.24	1.89	5.3
Aug	25.27	.21	64.8	74.3	72.6	90	54	83.2	62.1	59	60	80	22	4.54	.94	6.2
Sept	25.26	.32	61.9	74.5	70.4	89	55	80.8	60.1	52	52	69	47	1.86	.63	4.2
Oct	25.23	.36	53.1	63.1	61.4	78	39	71.9	50.9	34	37	51	39	1.62	.49	2.1
Nov	25.28	.51	44.2	51.5	50.8	77	24	60.6	41.1	27	30	53	45	.34	.25	1.4
Dec	25.29	.39	42.7	49.2	48.6	67	30	56.8	40.4	30	35	62	58	2.01	.88	5.8
Means	25.23	.36	53.2	65.1	61.0	96	19	71.6	50.5	35	85	53	38	16.74	......	3.5

Annual Meteorological Summary for the Year Ending December 31, 1890—Continued,

FORT DU CHESNE, UTAH.

[H=4,900. T=12½. h=3½.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	2.0	30	W.	S.	7	8	5	3	11	3	5	9	11	7	15	9	6	23	31	0	0	0
Feb	4.0	38	W.	SE.	9	7	3	15	6	1	5	5	5	14	11	3	3	3	28	0	0	0
Mar	4.7	37	W.	W.	4	2	3	13	3	3	17	5	12	13	14	4	0	1	25	0	0	0
Apr	5.5	40	SW.	SE.	9	5	6	12	2	4	8	11	3	11	13	6	1	0	13	0	0	0
May	5.2	40	NW.	W.	4	6	4	13	3	5	20	7	0	15	13	3	0	0	1	0	0	0
June	4.6	37	W.	W.	2	0	2	7	5	9	11	6	1	16	12	2	0	0	0	2	0	0
July	4.6	42	SE.	W.	4	3	1	5	3	6	7	2	0	11	18	2	5	0	0	26	5	0
Aug	5.4	38	W.	N.	20	5	7	10	3	6	3	5	3	16	6	9	5	0	0	12	7	0
Sept	5.6	42	W.	N.	25	6	2	5	2	2	9	5	4	10	14	6	3	0	2	0	6	0
Oct.	5.0	48	SW.	N.	17	8	5	2	5	7	4	4	10	17	9	5	5	0	24	0	2	0
Nov	3.4	36	NW.	N.	19	5	4	1	5	1	3	12	10	15	9	6	1	0	26	0	0	0
Dec	2.8	18	NW.	NW.	9	6	1	11	3	4	2	19	7	9	11	11	4	4	31	0	0	0
Means	4.4	....	......	N.	129	61	43	97	51	51	94	90	66	154	145	66	33	31	181	40	20	0

FORT ELLIOTT, KANS.

[H=2,690. T=14. h=1.]

Jan	13.2	48	N.	SW.	12	4	0	10	7	14	4	10	1	14	9	8	7	3	20	0	1	0
Feb	14.4	60	N.	N.	17	2	2	7	6	10	2	10	0	9	14	5	1	2	20	0	0	0
Mar	14.3	66	NW.	N.	24	0	5	9	7	7	1	9	0	11	9	11	2	1	12	0	0	0
Apr	13.9	54	N.	N.	14	2	2	11	9	10	2	10	0	8	11	11	15	0	2	0	4	0
May	14.2	48	S.	S.	9	2	4	4	20	8	1	13	1	12	15	4	7	0	0	0	6	0
June	14.3	54	SW.	S.	1	2	0	7	25	15	2	4	4	16	13	1	4	0	0	14	0	0
July	10.7	45	NE.	S.	6	1	2	8	28	6	0	4	7	14	15	2	8	0	0	24	7	0
Aug	10.2	36	S.	S.	1	2	5	13	23	9	1	6	2	14	8	9	15	0	0	14	10	0
Sept.*	10.3	48	N.	N.	15	0	7	5	13	6	1	9	4	17	9	4	4	0	0	1	0	0
Oct	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Nov	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Dec.	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Means	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

*Station closed September 30.

FORT GRANT, ARIZ.

[H=4,916. T=14.09. h=3.71.]

Jan	5.8	26	E.	W.	5	8	5	4	4	8	20	7	1	22	4	5	5	1	11	0	0	0
Feb	6.5	36	E.	W.	8	6	3	3	3	5	23	6	0	20	3	5	6	0	7	0	0	0
Mar	8.5	46	E.	W.	8	3	6	6	2	4	22	11	0	14	15	2	2	0	4	0	0	0
Apr	6.4	30	E.	W.	8	4	9	2	2	8	20	6	1	12	15	3	4	0	1	0	0	0
May	7.2	28	E.	W.	7	4	4	2	0	7	25	13	0	27	3	1	1	0	0	1	0	0
June	7.2	32	E.	W.	11	4	4	3	0	13	16	9	0	18	9	3	4	0	0	2	1	0
July	6.1	34	SE.	W.	6	3	12	7	5	4	18	7	0	4	24	3	12	0	0	14	6	0
Aug	4.7	30	SE.	W.	10	6	5	7	4	8	14	8	0	4	20	7	17	0	0	0	10	0
Sept	5.0	24	SE.	W.	10	2	6	2	3	11	16	9	1	12	15	3	8	0	0	0	2	0
Oct.	4.9	36	E.	N.	16	4	10	2	3	3	10	10	4	23	4	4	6	0	0	0	0	0
Nov	8.3	34	E.	N.	13	12	10	1	0	2	10	12	0	24	4	2	3	0	2	0	0	0
Dec.	7.1	36	E.	N.	15	4	11	3	2	3	13	11	0	8	12	11	7	0	1	0	0	...
Means	6.5	....	......	W.	117	59	85	42	28	76	207	109	7	188	128	49	75	1	26	17	19	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

FORT MCKINNEY, WYO.

[Lat., 43° 48' N.; long., 106° 10' W.]

Months and year.	Pressure (actual).		Temperature.							Dew point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a.m.	8 p.m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a.m.	8 p.m.	8 a.m.	8 p.m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	24.81	.70	11.4	14.5	15.8	+57	—23	27.7	4.0	3	6	68	69	.15	.07	2.8
Feb	24.81	.90	17.0	22.0	23.0	66	—22	34.8	11.1	10	13	78	69	.50	.39	6.1
Mar	24.84	.90	30.0	36.8	35.5	68	6	45.4	25.6	25	30	81	76	.86	.55	5.8
Apr	24.94	.70	37.9	49.2	45.0	80	13	56.5	33.4	31	39	77	70	.76	.44	5.6
May	24.90	.70	46.2	55.6	51.8	80	27	63.4	40.1	37	45	72	70	1.83	.50	6.2
June	24.92	.60	57.7	60.6	60.2	80	30	72.0	48.8	40	43	56	47	1.14	.70	4.5
July	24.99	.50	69.2	79.0	72.2	97	51	84.9	59.6	45	44	46	32	.88	.42	3.0
Aug	25.02	.40	65.0	72.0	67.6	92	44	79.0	56.2	44	45	48	40	.88	.63	3.5
Sept	24.98	.70	52.8	63.1	59.1	84	22	71.0	47.2	30	34	49	37	.01	.01	3.1
Oct	24.94	.70	41.2	46.6	46.5	71	28	56.5	36.5	29	29	66	54	1.20	.04	4.1
Nov	25.04	.80	38.1	41.0	41.6	69	7	52.1	31.0	23	23	58	52	.05	.02	3.6
Dec	25.09	.90	33.7	35.2	34.8	68	5	45.0	24.1	23	23	68	64	.03	.02	4.6
Means	24.98	.71	41.7	48.4	46.1	97	—23	57.4	34.8	28	31	64	57	8.29	......	4.4

FORT SILL, OKLA.

[Lat., 34° 40' N.; long., 98° 23' W.]

Jan*	28.88	.92	32.6	41.2	30.8	70	12	49.9	29.6	29	32	86	72	1.58	.54	5.4
Feb	28.78	.89	34.9	47.1	45.0	82	6	57.0	32.9	31	33	86	60	.40	.38	3.4
Mar	28.70	1.02	40.3	50.7	51.4	89	14	64.7	38.2	34	37	80	51	.36	.25	5.5
Apr	28.78	.57	52.0	63.6	60.8	91	31	70.6	50.9	49	51	88	68	3.77	3.56	5.8
May	28.66	.53	60.9	71.8	68.7	88	42	80.0	57.4	57	59	87	66	4.46	1.02	3.9
June	28.72	.58	71.2	82.6	78.1	100	54	90.2	66.0	65	63	80	53	.22	.19	2.1
July	28.74	.91	75.6	89.9	84.2	103	62	97.5	70.9	66	61	74	40	.44	.23	2.3
Aug	28.76	.38	72.3	85.7	81.2	103	61	93.4	69.1	67	61	83	51	3.00	1.91	3.6
Sept	28.79	.50	61.8	71.9	70.3	94	42	81.0	59.6	58	60	89	70	2.10	.82	3.0
Oct	28.70	.74	52.5	62.0	62.1	85	36	73.9	50.3	48	54	87	75	4.72	2.32	2.2
Nov	28.91	.78	39.6	51.8	50.4	80	27	63.1	37.7	36	42	86	70	4.06	3.90	3.4
Dec	28.89	1.08	34.9	45.7	44.9	72	15	56.5	33.3	30	35	83	68	.63	.41	2.9
Means	28.79	.69	52.4	64.2	61.4	103	6	73.2	49.7	48	49	81	62	30.90	......	3.6

*11th, 8 p.m. observations missed. *12th, 8 a.m. observations missed.

FORT SMITH, ARK.

[Lat., 35° 22' N.; long., 94° 24' W.]

Jan	29.67	.96	41.8	49.0	46.4	80	14	55.8	36.9	38	41	86	76	8.97	1.67	6.5
Feb	29.55	.90	41.9	49.0	48.0	78	7	58.1	38.0	37	38	84	69	6.27	1.54	5.3
Mar	29.56	1.07	43.6	53.9	50.4	82	15	61.2	39.7	36	40	74	62	5.99	3.16	5.4
Apr	29.54	.53	56.4	65.5	62.2	88	39	71.3	53.0	50	51	82	64	8.17	2.35	5.7
May	29.42	.50	62.5	72.2	69.0	89	46	80.8	57.6	56	56	79	58	5.36	2.31	4.1
June	29.49	.46	73.7	82.0	78.8	100	58	89.2	67.4	67	67	80	61	3.02	.84	3.0
July	29.50	.39	70.1	81.7	82.6	101	58	94.7	70.4	69	68	79	58	2.71	2.10	4.0
Aug	29.53	.39	71.8	80.5	77.9	98	60	88.2	67.6	67	68	85	68	10.89	5.10	4.7
Sept	29.54	.43	64.1	70.6	69.8	91	44	78.5	61.1	60	63	88	78	7.83	2.48	5.6
Oct	29.53	.63	52.6	62.7	60.2	88	32	71.6	48.9	48	50	86	65	2.83	.88	3.4
Nov	29.65	.58	45.3	57.2	53.6	81	30	65.2	41.9	41	43	85	61	5.60	3.46	4.1
Dec	29.66	.99	37.4	48.9	45.0	77	20	56.1	33.8	31	35	79	60	2.50	1.88	4.4
Means	29.55	.64	55.6	64.7	62.0	101	7	72.5	51.4	50	52	82	65	64.03	......	4.7

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

FORT McKINNEY, WYO.

[H=5,000. T=15. h=36.]

Months and year.	Wind. Average hourly velocity.	Wind. Maximum.	Wind. Direction.	Wind. Prevailing direction.	Wind. North.	Wind. Northeast.	Wind. East.	Wind. Southeast.	Wind. South.	Wind. Southwest.	Wind. West.	Wind. Northwest.	Wind. Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	8.0	60	SW.	W.	7	5	1	3	3	12	16	0	6	21	6	4	6	18	29	0	0	0
Feb	9.3	84	SW.	NW.	0	8	2	2	2	8	5	12	8	7	8	13	7	12	25	0	0	0
Mar	7.9	58	S.	NW.	8	4	3	7	9	5	3	13	10	7	11	13	11	3	23	0	0	0
Apr	7.8	66	NW.	N.	11	6	0	8	4	9	9	10	6	7	10	13	8	0	12	0	0	0
May	9.4	54	N.	NW.	15	6	2	3	3	7	6	16	4	4	14	13	15	0	3	0	0	0
June	9.2	48	SW.	N.	16	4	1	6	6	8	3	16	2	11	14	5	9	0	1	0	0	0
July	11.0	51	NW.	N.	15	7	3	11	4	5	7	10	0	19	11	1	9	0	0	7	5	0
Aug	9.3	40	NW.	NW.	15	3	3	8	6	3	8	15	1	15	14	2	8	0	0	1	3	0
Sept	10.1	50	NW.	NW.	9	7	4	4	2	3	14	15	2	15	12	3	1	0	2	0	0	0
Oct	9.2	48	NW.	W.	13	6	1	2	2	5	17	16	0	18	10	8	8	0	8	0	0	0
Nov	9.5	46	NW.	W.	10	1	1	1	3	4	80	3	1	15	9	6	3	2	12	0	0	0
Dec	7.4	50	N.	W.	12	3	0	1	5	6	29	6	0	14	8	9	2	5	24	0	0	0
Means	9.0	....	......	W.	140	60	21	56	49	75	150	139	40	148	127	90	80	40	130	8	8	0

FORT SILL, OKLA.

[H=1,200. T=9.5. h=3.2.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan	10.3	44	N.	N.	14	0	1	1	13	1	1	0	8	5	6	7	7	2	12	0	0	0
Feb	18.2	37	S.	N.	25	2	1	1	20	2	0	1	4	15	8	5	4	2	10	0	0	0
Mar	18.0	60	NW.	N.	21	6	3	6	12	1	1	4	8	9	12	10	6	0	8	0	1	0
Apr	12.0	48	NW.	S.	13	5	4	7	16	2	0	8	5	7	11	12	12	0	0	1	5	0
May	11.3	38	S.	S.	19	5	1	5	24	1	0	2	5	13	14	4	11	0	0	0	8	0
June	12.9	36	S.	S.	7	2	2	4	40	1	0	0	4	21	9	0	3	0	0	16	0	0
July	10.0	36	E.	S.	10	3	3	7	33	0	0	1	5	20	11	0	4	0	0	29	0	0
Aug	8.9	34	N.	S.	15	5	4	7	25	1	0	0	5	14	14	3	6	0	0	23	1	0
Sept	9.6	38	S.	N.	26	2	3	6	17	0	0	0	6	16	12	2	6	0	0	8	1	0
Oct	9.8	38	N.	S.	17	2	0	3	21	2	0	2	15	21	8	2	6	0	0	0	2	0
Nov	7.5	30	N.	N.	32	0	0	0	15	1	1	1	10	17	8	5	7	0	4	0	1	0
Dec	8.2	30	S.	N.	25	1	0	0	18	1	0	2	15	17	12	2	5	0	15	0	0	0
Means	10.6	....	......	S.	224	33	22	47	254	13	3	21	90	175	125	52	77	4	49	77	10	0

FORT SMITH, ARK.

[H=492. T=73. h=65.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan	7.2	32	W.	E.	1	6	24	3	11	3	0	7	1	9	6	16	12	0	13	0	2	0
Feb	8.0	36	W.	E.	6	7	10	5	5	2	4	8	0	11	5	12	12	1	7	0	2	0
Mar	8.8	42	S.	E.	2	15	23	2	6	2	2	9	1	12	6	13	9	0	7	0	2	0
Apr	8.2	30	E.	E.	0	6	22	5	6	6	3	9	3	12	5	13	13	0	0	0	1	0
May	6.1	38	NE.	E.	8	9	17	9	7	2	3	4	3	15	10	6	14	0	0	0	1	0
June	5.4	25	N.	E.	2	5	20	9	18	1	8	2	0	21	7	2	7	0	0	14	4	0
July	4.0	25	NE.	E.	4	8	28	11	7	3	1	0	0	17	12	2	6	0	0	29	2	0
Aug	4.6	24	NW.	E.	5	8	25	11	6	3	1	3	0	16	7	8	13	0	0	10	1	0
Sept	5.4	33	NW.	E.	9	11	20	7	2	3	3	5	0	12	6	12	13	0	0	2	0	0
Oct	5.7	36	W.	E.	8	1	27	5	8	4	4	5	0	22	1	8	10	0	0	0	2	0
Nov	5.2	24	NW.	E.	4	9	12	5	6	8	8	8	0	18	2	10	8	0	2	0	0	0
Dec	6.3	24	W.	E.	5	10	22	3	5	6	6	5	0	14	10	7	5	0	16	0	0	0
Means	6.3	....	......	E.	54	95	259	75	87	43	44	65	8	179	77	109	122	1	45	55	17	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

FORT STANTON, N. MEX.

[Lat., 33° 30′ N.; long., 105° 26′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a. m.	Dew-point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	23.98	.54	27.8	42.2	38.4	69	8	52.3	24.5	20	20	72	60	.37	.25	3.6
Feb	23.91	.64	33.1	45.7	42.2	76	13	54.6	29.7	21	22	62	43	.08	.05	2.4
Mar	23.93	.65	37.2	53.3	46.6	75	6	60.5	32.6	15	12	45	26	.12	.12	4.5
Apr	23.97	.45	40.7	58.5	51.1	75	14	64.9	37.3	25	22	54	30	.57	.26	4.0
May	23.93	.32	51.2	71.2	61.0	85	36	75.9	46.2	27	17	42	16	0	0	2.2
June	24.01	.36	55.4	75.0	65.8	90	39	81.3	50.3	28	20	38	22	1.05	.36	4.0
July	24.07	.25	62.3	76.5	70.2	90	51	83.1	57.3	49	44	64	34	1.92	.47	3.7
Aug	24.00	.32	59.4	71.0	66.3	85	50	77.6	55.0	48	50	68	51	2.93	.58	5.2
Sept	24.08	.35	51.7	65.7	60.3	84	42	72.5	48.1	44	46	74	53	1.52	.57	4.4
Oct	24.02	.47	39.9	59.3	52.2	75	24	67.3	37.0	28	37	62	44	.40	.40	1.5
Nov	24.08	.63	30.2	45.7	39.7	69	12	53.4	26.0	19	32	66	62	1.85	.52	4.0
Dec	24.04	.69	33.8	40.4	39.0	62	15	51.4	26.5	25	29	70	66	1.06	.61	5.6
Means	24.01	.47	43.6	58.7	52.7	90	6	66.2	39.2	29	30	60	42	11.87	......	3.8

FORT SULLY, S. DAK.

[Lat., 40° 39′ N.; long., 100° 39′ W.]

Jan	28.42	1.11	−1.2	4.1	2.0	46	−25	10.1	−6.1	−7	−2	77	78	.15	.05	3.7
Feb	28.36	1.10	8.4	17.6	15.0	56	−30	26.0	3.9	2	9	76	69	.20	.09	5.1
Mar	28.32	1.13	22.0	33.2	29.2	69	−12	39.3	19.2	16	20	78	61	.28	.07	5.0
Apr	28.31	1.16	41.9	59.0	51.2	86	18	64.4	38.0	32	32	68	38	.58	.29	4.2
May	28.19	.92	48.3	64.2	55.8	90	29	69.1	42.5	36	36	63	38	1.27	.55	4.9
June	28.17	1.02	62.4	76.6	70.2	99	49	82.1	58.3	56	57	80	53	6.41	3.80	6.0
July	28.24	.68	67.8	85.1	77.3	103	55	90.4	64.2	57	58	70	43	.25	.15	4.1
Aug	28.28	.66	61.2	79.6	71.8	102	43	85.5	58.0	51	50	71	37	.61	.21	4.5
Sept	28.30	.87	49.8	66.9	61.0	93	33	75.0	46.9	41	44	74	48	1.54	1.03	3.8
Oct	28.24	.84	40.8	52.8	49.6	85	21	60.8	38.5	31	32	71	48	.54	.36	5.5
Nov	28.41	1.06	30.7	41.5	39.0	77	8	51.0	27.1	23	28	75	61	1.01	.84	3.8
Dec	28.35	.88	23.4	29.7	28.0	62	− 2	38.4	17.5	17	18	78	64	.44	.24	4.9
Means	28.30	.95	38.0	50.9	45.8	103	−30	57.7	34.0	30	32	73	53	13.28	......	4.6

FORT WASHAKIE, WYO.

[Lat., 43° 1′ N.; long., 108° 54′ W.]

Jan	24.34	.77	6.0	13.7	11.2	43	−22	23.8	−1.3	0	5	76	72	.97	.55	4.3
Feb	24.32	1.07	16.8	29.7	25.4	60	−24	35.8	15.0	11	10	73	49	.31	.11	5.1
Mar	24.36	.78	23.7	42.0	34.2	60	− 4	47.7	20.8	15	16	72	40	.74	.52	4.0
Apr	24.45	.53	34.0	52.6	42.4	72	6	56.2	28.5	21	16	65	30	.64	.29	4.8
May	24.40	.58	45.2	61.1	52.3	80	28	66.7	37.0	31	26	60	31	.46	.16	4.7
June	24.45	.54	52.0	69.7	59.0	84	31	74.3	43.8	36	27	56	23	.44	.40	3.8
July	24.53	.49	59.7	81.4	69.4	93	37	86.3	52.5	45	49	61	36	.97	.85	3.4
Aug	24.54	.40	53.6	75.0	63.8	91	39	79.5	48.2	41	45	65	38	.73	.26	3.5
Sept	24.53	.68	43.2	68.2	56.0	83	24	72.7	39.4	27	33	56	29	.40	.40	2.4
Oct	24.48	.60	34.2	46.1	41.7	71	17	54.7	28.7	24	25	67	48	1.82	1.33	4.2
Nov	24.60	.78	25.1	34.3	33.1	69	9	46.0	20.2	17	22	72	64	.26	.20	3.0
Dec	24.49	.79	21.0	31.2	28.7	57	3	41.8	15.6	15	14	77	54	T	T	3.6
Means	24.46	.67	34.7	50.4	43.1	93	−24	57.1	29.1	24	24	67	43	7.74	......	3.9

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

FORT STANTON, N. MEX.

[H=6,160. T=16.6. h=2.3.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.*	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	8.1	44	SW.	SW.	4	2	1	8	4	19	10	3	11	12	15	4	4	2	25	0	0	0
Feb	10.4	54	SW.	SW.	3	5	1	3	3	16	9	13	3	17	8	3	2	2	16	0	0	0
Mar	8.8	54	W.	NW.	8	3	4	6	1	9	12	14	5	8	22	1	1	0	15	0	0	0
Apr	7.0	40	W.	SW.	0	1	2	6	2	16	11	5	17	8	17	5	4	1	7	0	0	0
May	6.4	44	SW.	SW.	2	0	2	12	1	13	5	10	17	19	12	0	0	0	0	0	0	0
June	5.1	36	SW.	SW.	2	1	0	9	2	14	8	4	20	12	16	2	6	0	0	1	2	0
July	4.3	36	SW.	SE.	2	2	2	16	3	11	5	4	17	16	12	3	8	0	0	0	0	0
Aug	4.0	30	SW.	SE.	2	3	3	17	4	16	4	3	10	7	17	7	11	0	0	0	0	0
Sept	3.5	28	NW.	SE.	1	0	0	18	2	12	6	5	16	11	12	7	6	0	0	0	0	0
Oct	5.9	36	SW.	SW.	5	0	0	1	3	28	4	6	15	24	7	0	1	0	7	0	0	0
Nov	3.8	38	SE.	SW.	2	0	0	4	1	11	6	4	32	14	7	9	9	1	26	0	0	0
Dec	4.4	48	NW.	NW.	1	0	0	5	0	10	2	12	32	7	14	10	4	0	27	0	0	0
Means	6.0	....	......	SW.	32	17	15	105	26	175	82	83	105	155	159	51	56	6	123	1	2	0

FORT SULLY, S. DAK.

[H=1,600. T=16.1. h=2.5.]

Jan	6.8	36	NW.	NW.	1	5	8	6	0	2	9	21	5	16	10	5	6	23	28	0	0	0
Feb	9.3	43	NW.	NW.	9	3	6	12	1	0	7	16	2	9	13	6	6	16	28	0	0	0
Mar	11.2	46	NW.	SE.	10	3	9	16	3	2	4	12	3	8	18	5	9	10	24	0	0	0
Apr	10.2	54	NE.	SE.	3	5	6	22	6	0	6	11	1	13	9	8	4	0	10	0	0	0
May	13.4	52	N.	NW.	8	5	5	15	0	1	5	22	1	11	13	7	8	0	4	0	1	0
June	13.1	66	W.	SE.	6	1	5	24	5	0	2	16	1	4	16	10	16	0	0	5	14	0
July	11.8	42	NW.	SE.	10	4	8	20	4	0	1	8	7	14	11	6	4	0	0	16	8	0
Aug	10.6	56	NW.	SE.	12	1	2	18	5	4	0	16	4	10	15	6	9	0	0	8	2	0
Sept	10.2	40	NW.	NW.	8	3	4	17	0	0	5	21	2	15	9	6	5	0	0	1	4	0
Oct	10.8	42	NW.	NW.	5	4	4	12	0	1	2	31	3	8	12	11	6	0	4	0	0	0
Nov	7.4	42	NW.	NW.	7	5	5	4	1	2	3	32	1	17	8	5	5	4	22	0	0	0
Dec	8.2	54	NW.	NW.	3	4	8	12	1	1	2	28	3	10	14	7	5	9	30	0	0	0
Means	10.2	....	......	NW.	82	43	70	178	26	13	46	234	33	135	148	82	83	62	150	30	29	0

FORT WASHAKIE, WYO.

[H=5,580. T=23.2. h=16.2½.]

Jan	4.3	34	SW.	SW.	1	5	1	2	0	30	15	2	6	19	5	7	5	23	31	0	0	0
Feb	7.4	50	SW.	SW.	3	9	2	2	2	20	8	8	2	10	9	9	3	8	25	0	0	0
Mar	8.4	40	W.	SW.	0	2	2	7	4	20	18	8	1	18	8	5	3	5	27	0	0	0
Apr	7.2	36	W.	SW.	3	7	1	5	2	20	17	5	0	15	8	7	5	0	21	0	0	0
May	7.2	49	NW.	SW.	3	7	3	8	0	19	17	5	0	10	16	5	7	0	5	0	0	0
June	7.6	36	SW.	SW.	1	5	1	2	6	26	13	6	0	14	13	3	3	0	1	0	0	0
July	6.5	47	W.	SW.	2	7	0	4	3	23	10	3	1	20	8	3	5	0	0	4	0	0
Aug	5.5	36	W.	SW.	7	6	1	3	6	23	13	2	1	18	10	3	6	0	0	1	0	0
Sept	5.2	36	NE.	SW.	2	7	3	4	7	30	4	2	1	20	9	1	2	0	3	0	0	0
Oct	5.1	40	SW.	SW.	0	5	0	2	4	29	12	4	6	16	9	6	6	0	24	0	0	0
Nov	4.0	44	W.	SW.	0	7	1	2	2	31	15	2	0	19	8	8	2	3	30	0	0	0
Dec	4.6	30	SW.	SW.	2	6	2	2	3	29	14	1	3	17	11	3	0	4	31	0	0	0
Means	6.1	....	......	SW.	24	73	17	43	39	300	165	48	21	196	114	55	48	43	198	5	0	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

FRESNO, CAL.

[Lat., 36° 43′ N.; long., 119° 49′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a.m.	Temperature. 8 p.m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a.m.	Dew-point. 8 p.m.	Relative humidity. 8 a.m.	Relative humidity. 8 p.m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.77	.71	37.0	47.1	42.2	58	24	50.0	34.3	34	39	90	74	2.12	0.74	5.9
Feb	29.75	.66	40.3	54.2	47.2	70	28	56.4	37.9	36	40	85	62	0.80	0.30	5.6
Mar	29.73	.66	46.6	61.9	54.6	77	33	65.1	44.1	42	43	85	52	1.04	0.33	5.4
Apr	29.65	.45	49.0	72.7	61.2	92	36	75.4	47.0	45	42	86	35	0.17	0.15	3.1
May	29.56	.58	56.4	81.5	69.4	103	42	83.8	55.0	50	45	79	31	0.45	0.43	3.2
June	29.56	.42	57.7	88.0	73.4	104	46	90.1	56.7	46	39	66	18	.00	.00	1.0
July	29.51	.40	65.6	98.9	82.5	111	56	100.9	64.1	44	39	47	13	.00	.00	0.7
Aug	29.51	.37	65.5	95.9	80.8	105	56	97.8	63.9	50	45	58	19	T.	T.	1.6
Sept	29.52	.35	61.3	88.0	74.6	103	53	90.4	58.8	50	47	67	29	1.26	1.12	2.6
Oct	29.61	.57	52.1	76.8	64.5	88	42	80.1	48.9	44	42	73	29	.00	.00	1.0
Nov	29.73	.59	45.5	67.4	56.9	82	37	71.8	42.0	37	38	73	36	0.22	0.22	1.5
Dec	29.78	.76	40.0	46.8	43.8	70	28	49.4	38.2	39	43	97	89	2.80	1.21	8.4
Means	29.64	.54	51.4	73.3	62.6	111	24	75.9	49.2	43	42	76	41	8.36	......	3.3

GALVESTON, TEX.

[Lat., 29° 18′ N.; long., 94° 50′ W.]

Jan	30.16	.67	62.1	65.0	64.0	74	35	68.5	59.6	60	62	94	90	2.86	0.88	5.1
Feb	30.03	.72	62.0	63.8	63.7	75	34	68.4	59.0	59	59	89	85	1.92	1.04	4.7
Mar	30.04	.91	59.6	62.9	62.1	76	30	66.7	57.5	54	57	83	82	4.96	2.91	6.0
Apr	30.04	.37	67.9	70.2	69.8	81	56	74.4	65.2	63	63	85	79	5.14	2.74	6.3
May	29.92	.45	73.6	75.8	75.0	85	63	79.7	70.3	67	68	80	77	5.38	2.87	4.0
June	30.00	.30	78.7	80.2	80.3	90	65	84.5	76.1	73	73	84	78	7.42	3.49	3.6
July	29.97	.34	80.7	82.7	82.7	92	71	87.4	78.0	75	74	83	76	1.82	0.99	4.3
Aug	29.99	.34	81.0	82.3	82.6	90	70	87.4	77.7	74	72	80	72	5.09	2.32	4.7
Sept	29.98	.31	76.0	78.6	77.8	87	56	82.4	73.3	69	69	81	74	4.79	2.62	4.3
Oct	30.00	.63	69.0	72.1	72.0	89	54	76.8	67.1	63	64	83	76	4.38	1.99	3.8
Nov	30.12	.48	62.6	66.6	64.7	79	49	70.2	59.2	57	60	82	79	2.37	1.80	3.9
Dec	30.17	.76	55.8	60.2	58.0	76	37	63.1	52.8	53	56	90	85	1.67	1.67	5.5
Means	30.04	.52	69.1	71.7	71.1	92	30	75.8	66.3	64	65	84	79	47.80	......	4.7

GRAND HAVEN, MICH.

[Lat., 43° 5′ N.; long., 86° 13 W.]

Jan	29.42	1.40	29.3	31.5	30.6	61	5	36.7	24.5	25	25	84	80	2.83	0.57	8.1
Feb	29.35	.98	29.0	31.4	30.8	51	13	36.4	25.3	24	26	82	82	2.29	0.62	7.6
Mar	29.37	1.06	25.0	29.2	28.4	51	14	34.6	22.2	20	21	83	72	2.98	0.95	6.9
Apr	29.43	1.20	41.1	47.3	44.2	70	22	53.5	35.0	31	32	69	60	3.07	0.58	4.7
May	29.23	.83	48.0	51.9	50.4	78	28	57.4	43.5	41	40	77	68	5.82	1.61	6.5
June	29.30	.65	66.3	69.6	68.0	89	43	76.0	59.0	58	58	77	70	3.11	0.99	5.0
July	29.33	.57	65.9	70.4	68.0	86	48	75.6	60.3	57	54	74	69	0.90	0.84	3.5
Aug	29.38	.59	61.5	65.7	63.8	90	42	71.9	55.8	55	54	78	67	2.78	0.97	4.3
Sept	29.44	.77	53.9	60.1	57.8	83	34	66.9	48.6	48	49	82	68	1.72	7.08	4.4
Oct	29.25	.82	46.0	49.8	49.8	78	32	56.8	42.8	42	42	85	75	4.12	1.15	6.7
Nov	29.35	.74	39.2	41.1	40.4	56	27	46.3	34.6	32	33	77	74	1.91	0.66	6.5
Dec	29.38	.95	27.2	30.4	29.6	48	6	35.8	23.4	22	22	83	74	1.28	0.28	6.6
Means	29.35	.88	44.4	48.2	46.8	90	14	54.0	39.7	38	38	79	71	33.26	......	5.9

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

FRESNO, CAL.

[H=338. T=77.5, h=65.5.]

Months and year.	Wind.													Number of days.								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	5.3	23	NW.	E.	7	0	23	9	5	1	8	8	1	6	13	12	11	0	0	0	0	0
Feb	5.2	26	E.	E.	7	1	13	7	10	2	9	6	1	6	13	9	7	0	3	0	0	0
Mar	5.6	24	NW.	NW	9	0	11	5	2	8	12	16	4	9	10	12	6	0	0	0	0	0
Apr	6.2	20	NW.	NW.	11	1	5	2	0	2	15	22	2	17	9	4	2	0	0	1	0	0
May	7.2	22	NW.	NW.	7	1	5	0	0	3	20	26	0	19	6	6	3	0	0	9	0	0
June	8.4	22	W.	W.	7	0	0	0	1	2	25	24	1	26	4	0	0	0	0	14	0	0
July	7.5	22	W.	NW.	6	0	2	0	2	0	19	32	1	30	1	0	0	0	0	30	0	0
Aug	6.7	22	NW.	NW.	4	1	1	0	4	2	24	26	0	26	4	1	0	0	0	30	0	0
Sept	5.2	24	N.	NW.	3	0	2	3	5	2	20	25	1	20	6	4	5	0	0	18	0	0
Oct	4.5	34	NW.	NW.	1	2	4	12	5	4	5	26	3	28	3	0	0	0	0	0	0	0
Nov	3.2	22	W.	W.	7	0	11	11	5	1	12	7	6	24	4	2	1	0	0	0	0	0
Dec	3.4	18	SE.	S.	6	0	7	7	15	2	14	10	1	1	6	24	6	0	4	0	0	0
Means.	5.7	....	......	NW.	75	6	84	55	54	24	183	228	21	212	79	74	42	0	10	102	0	0

GALVESTON, TEX.

[H=42. T=93.0. h=87.9.]

Jan	12.4	46	N.	SE.	9	6	7	20	15	3	0	2	0	9	15	7	8	0	0	0	0	0
Feb	12.1	42	N.	S.	7	4	4	13	19	6	1	1	1	11	7	10	5	0	0	0	2	0
Mar	14.2	48	NE.	SE.	7	12	3	16	18	3	0	3	0	10	8	18	7	0	1	0	3	0
Apr	12.9	42	N.	SE.	7	6	4	20	18	8	1	1	0	8	8	14	9	0	0	0	5	0
May	11.9	40	NE.	S.	6	6	5	27	31	8	0	0	0	16	12	3	8	0	0	0	6	0
June	10.8	54	NE.	S.	5	3	1	7	32	8	4	0	0	20	6	4	5	0	0	0	8	0
July	8.4	36	NE.	S.	7	1	1	15	22	9	4	3	0	18	6	7	9	0	0	2	10	0
Aug	8.1	28	NE.	SE.	4	5	3	10	21	4	4	1	1	13	14	4	13	0	0	0	0	0
Sept	9.8	32	S.	SE.	4	11	2	19	10	7	1	6	0	15	11	4	10	0	0	0	3	0
Oct	10.9	38	NE.	SE.	6	11	6	16	8	4	3	8	0	18	10	3	8	0	0	0	0	0
Nov	10.3	36	NW.	NE.	12	15	6	11	8	3	1	9	0	20	3	7	4	0	0	0	0	0
Dec	11.9	36	NW.	SE.	10	8	4	17	9	6	3	5	0	12	8	11	3	0	0	0	0	0
Means.	11.1	....	......	S.	84	88	46	194	196	59	22	39	2	170	108	87	89	0	1	2	32	0

GRAND HAVEN, MICH.

[H=621. T=55. h=47.]

Jan	13.7	58	SW.	W.	4	0	7	10	12	4	13	12	0	2	8	21	19	10	25	0	0	0
Feb	11.0	36	NW.	E.	6	6	11	8	6	6	6	7	0	3	8	17	18	6	21	0	0	0
Mar	12.5	47	W.	N.	9	9	7	9	5	5	9	8	1	5	10	16	20	10	27	0	0	0
Apr	11.8	42	S.	S.	10	8	14	8	13	4	3	4	4	11	11	7	13	0	7	0	2	0
May	11.4	39	S.	S.	5	5	8	4	16	8	5	8	3	6	12	13	15	0	1	0	5	0
June	8.4	42	SW.	S.	2	4	10	6	14	11	8	3	2	10	14	6	12	0	0	0	2	0
July	10.3	37	N.	S.	13	3	5	1	19	9	7	3	2	14	15	2	7	0	0	0	8	0
Aug	8.5	32	SW.	N.	10	4	9	6	8	6	8	9	3	12	15	4	10	0	0	0	0	0
Sept	9.6	42	W.	S.	10	13	10	5	14	1	5	1	1	14	9	7	8	0	0	0	0	0
Oct	10.3	52	N.	N.	18	4	14	7	2	1	9	4	3	5	9	17	10	0	1	0	0	0
Nov	12.6	43	W.	SW.	8	6	7	6	3	12	8	9	1	6	9	15	10	0	0	0	0	0
Dec	13.1	51	W.	N.	10	10	6	10	6	5	10	5	0	9	4	18	10	11	26	0	0	0
Means.	11.1	....	......	S.	105	73	105	75	118	72	91	73	19	97	125	148	158	37	118	0	15	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

GREEN BAY, WIS.

[Lat., 44° 31′ N.; long., 88° 0′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.44	1.40	15.9	21.2	19.0	43	—22	26.0	11.9	12	17	84	84	3.29	1.52	6.7
Feb	29.36	1.15	19.6	95.0	22.5	44	— 4	29.0	16.0	16	19	88	81	3.16	1.37	6.9
Mar	29.39	1.13	16.2	25.8	22.6	44	—23	31.3	13.8	12	19	84	78	1.86	.80	5.2
Apr	29.44	1.08	40.7	44.3	54.2	73	20	53.6	34.7	32	33	73	67	2.75	.89	5.3
May	29.24	.83	45.9	51.9	49.1	81	28	58.0	40.2	39	40	79	67	3.09	.75	7.4
June	29.29	.68	67.0	71.2	69.4	94	47	79.1	59.8	59	60	78	69	5.18	1.50	6.4
July	29.32	.59	67.2	72.8	70.4	92	48	80.4	60.3	58	61	73	66	4.50	.99	5.5
Aug	29.39	.63	61.4	65.2	64.6	91	41	74.3	55.0	55	55	80	71	4.61	1.79	5.7
Sept	29.44	.83	52.9	58.9	57.2	86	32	67.8	46.7	48	48	83	71	1.77	.75	5.5
Oct	29.28	.82	43.9	46.0	47.7	71	26	54.2	41.2	40	42	87	79	3.57	1.35	7.6
Nov	29.37	.75	31.5	36.3	35.2	56	20	41.1	29.4	26	30	82	80	1.72	.70	6.2
Dec	29.40	1.01	20.8	26.0	24.4	47	2	30.9	17.8	15	20	78	78	0.75	.16	6.3
Means	29.36	.91	40.2	45.5	43.0	94	—23	52.1	35.6	34	37	81	74	36.24	......	6.2

HARRISBURG, PA.

[Lat., 40° 16′ N.; long., 76° 52′ W.]

Jan	29.83	1.02	35.4	39.8	38.0	67	15	45.6	30.5	30	31	81	80	2.01	1.02	6.8
Feb	29.71	98	35.4	39.8	37.6	74	18	44.6	30.7	30	32	90	75	3.39	.91	6.8
Mar	29.06	1.13	33.2	37.9	35.6	72	8	42.3	29.0	26	30	76	73	3.80	.84	6.1
Apr	29.72	1.11	47.5	55.5	50.8	81	28	60.8	40.8	35	40	65	58	2.46	.98	4.4
May	29.57	68	58.0	62.8	60.8	79	38	70.0	51.6	47	50	68	65	6.61	3.05	6.2
June	29.61	.58	69.4	74.8	72.4	92	51	82.1	62.6	57	61	67	63	2.97	1.88	5.2
July	29.64	.56	70.7	75.4	72.7	96	50	82.2	63.2	60	59	69	58	2.86	.50	5.1
Aug	29.65	.51	68.8	71.9	71.2	88	50	79.3	63.1	60	62	74	72	5.70	2.30	5.3
Sept	29.74	.47	61.4	65.7	64.2	86	42	72.8	55.7	55	57	81	75	2.89	1.09	5.3
Oct	29.54	.95	51.1	54.6	53.2	76	34	59.5	46.9	44	45	78	74	6.40	2.49	6.1
Nov	29.69	.78	40.4	45.2	43.4	64	22	50.5	36.3	33	34	77	68	1.12	.46	5.1
Dec	29.68	1.08	27.5	31.0	29.4	55	14	35.3	23.6	22	24	80	75	2.42	.84	5.7
Means	29.67	.82	49.9	54.5	52.4	96	8	60.4	44.5	42	44	75	70	42.63	......	5.7

HATTERAS, N. C.

[Lat., 35° 15′ N.; long., 75° 40′ W.]

Jan	30.29	.92	55.2	55.8	55.7	73	32	61.6	40.8	51	52	86	87	1.29	.55	3.9
Feb	30.13	.65	55.3	55.9	56.4	73	39	62.2	50.7	52	53	88	90	3.03	1.87	4.9
Mar	30.10	.87	52.0	52.6	52.6	72	26	58.5	46.6	45	47	77	81	3.06	.74	4.7
Apr	30.15	.90	58.0	58.0	58.0	74	44	63.7	52.4	52	52	82	83	4.28	1.16	4.3
May	30.00	.56	68.9	67.8	68.8	80	53	73.6	63.9	63	64	82	84	4.78	2.34	4.1
June	30.02	.54	77.2	76.0	77.2	90	67	82.0	72.5	72	72	84	86	4.04	1.49	3.9
July	30.07	.58	76.8	75.8	76.7	85	65	81.2	72.2	72	72	84	85	5.95	1.34	3.9
Aug	30.08	.54	75.4	75.0	76.0	84	65	80.3	71.7	70	70	84	84	8.51	3.24	3.5
Sept	30.09	.39	75.6	75.0	75.8	84	67	80.0	71.6	70	70	84	84	9.63	2.31	4.0
Oct	29.96	.78	64.1	64.9	65.0	81	44	69.5	60.6	56	57	77	75	4.93	2.97	3.5
Nov	30.14	.62	55.4	56.7	56.8	72	38	61.3	52.2	49	49	80	78	T.	T.	3.2
Dec	30.11	1.09	46.1	47.0	47.0	67	31	53.5	40.6	40	41	81	81	6.01	2.19	3.8
Means	30.10	.70	63.3	63.4	63.8	90	26	69.0	58.7	58	58	82	88	55.1	......	4.0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

GREEN BAY, WIS.

[*H*—616. *T*—49.2. *h*—42.5.]

Months and year.	Wind.												Number of days—									
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan....	7.2	33	W.	S.	10	5	1	2	16	1	8	4	6	6	10	15	11	18	29	0	0	0
Feb ...	10.1	30	N.	S.	14	3	1	2	24	4	3	4	1	6	5	17	11	17	27	0	0	0
Mar ...	8.7	45	N.	S.	10	5	3	7	17	4	8	4	4	11	11	9	7	11	28	0	0	0
Apr ...	9.6	33	N.	S.	8	13	6	12	15	1	1	4	0	10	9	11	13	0	7	0	1	0
May ...	9.4	33	SW.	NE.	6	12	8	10	11	8	2	4	1	3	11	17	19	0	6	0	1	0
June ..	7.4	33	S.	S.	6	5	9	13	16	4	4	3	0	4	15	11	13	0	0	2	7	0
July ...	7.4	28	SE.	S.	5	3	8	11	19	3	3	9	1	8	12	11	10	0	0	1	6	1
Aug ...	6.4	27	N.	SE.	11	2	7	16	10	2	6	7	1	9	8	14	15	0	0	1	4	0
Sept...	7.5	28	N.	S.	5	1	6	15	17	4	5	4	3	10	8	12	7	0	1	0	1	0
Oct	7.0	36	N.	S.	10	5	6	10	11	3	7	7	3	3	9	19	11	0	3	0	0	0
Nov ...	7.7	32	N.	S.	10	6	2	4	18	13	4	3	0	8	8	14	9	1	18	0	0	1
Dec....	8.1	36	W.	S.	6	4	1	6	22	4	6	10	3	8	8	15	8	17	29	0	0	0
Means.	8.0	....	......	S.	101	64	58	108	196	60	57	63	23	86	114	165	134	64	148	4	20	2

HARRISBURG, PA.

[*H*=377. *T*=93.6. *h*=86.8.]

Jan....	8.3	42	NW.	NW.	3	6	8	11	1	6	10	15	2	5	10	16	14	2	18	0	0	0
Feb ...	7.8	36	NW.	NW.	2	7	13	6	3	6	4	15	0	3	12	13	11	2	15	0	0	0
Mar ...	10.2	48	NW.	NW.	10	6	8	5	1	5	7	20	0	5	16	10	14	6	18	0	0	0
Apr ...	7.4	36	NW.	SW.	8	4	7	8	7	11	4	11	0	12	12	6	9	0	3	0	1	0
May ...	6.7	36	SW.	E.	11	1	11	8	8	6	8	9	0	6	13	12	17	0	0	0	3	0
June ..	5.4	39	W.	W.	3	3	10	4	9	5	16	10	0	10	11	9	10	0	0	3	7	0
July ...	6.1	36	SW.	W.	7	9	6	8	10	5	12	5	0	11	10	10	10	0	0	6	2	0
Aug ...	6.4	36	NW.	W.	3	4	7	6	11	2	14	14	1	10	13	8	15	0	0	0	3	0
Sept...	5.6	24	N.	E.	8	6	12	8	4	3	8	8	3	10	9	11	11	0	0	0	1	0
Oct....	7.7	36	NW.	W.	10	6	13	4	1	5	14	8	1	8	8	15	15	0	0	0	0	0
Nov ...	6.8	36	W.	W.	3	6	5	6	9	5	14	8	4	11	9	10	8	0	6	0	0	0
Dec ...	9.4	64	NE.	W.	6	10	12	2	2	3	21	5	1	10	8	13	12	8	28	0	0	0
Means.	7.8	....	......	W.	74	68	112	76	66	62	132	128	12	101	131	133	146	18	88	9	17	0

HATTERAS, N. C.

[*H*=11. *T*=17.2. *h*=2.5.]

Jan....	15.8	44	N.	SW.	11	10	1	4	13	14	4	5	0	14	11	6	11	0	0	0	0	0
Feb ...	16.4	60	NW.	SW.	6	14	1	1	5	22	4	3	0	10	9	9	8	0	0	0	0	0
Mar ...	19.0	54	N.	S.	12	6	3	1	17	10	5	7	1	10	15	6	8	0	3	0	1	0
Apr ...	16.5	44	NW.	SW.	13	10	4	0	10	15	4	3	1	14	10	6	10	0	0	0	2	0
May ...	13.2	38	NW.	S.	5	10	6	3	21	12	3	2	0	13	14	4	12	0	0	0	1	0
June ..	10.6	50	NW.	SW.	5	5	4	7	11	17	8	3	0	16	11	3	10	0	0	0	8	0
July ...	12.8	46	N.	S.	3	16	1	6	16	14	5	1	0	18	11	2	13	0	0	0	2	0
Aug ...	12.2	36	N.	SW.	11	3	3	2	14	22	5	2	0	17	10	4	14	0	0	0	5	0
Sept...	11.4	36	SE.	NE.	5	18	5	4	14	5	4	5	0	16	12	2	15	0	0	0	2	0
Oct	16.0	48	NW.	NW.	11	8	5	3	2	9	10	14	0	18	8	5	10	0	0	0	0	0
Nov ...	11.3	40	NW.	NE.	12	12	6	0	2	8	7	12	1	18	9	3	0	0	0	0	0	0
Dec....	15.9	42	NW.	NE.	10	16	2	4	1	15	3	11	0	19	6	6	10	0	2	0	2	0
Means.	14.3	....	......	SW.	104	128	41	35	126	163	62	68	3	183	126	56	121	0	5	0	23	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

HELENA, MONT.

[Lat., 46° 34′ N.; Long., 112° 4′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a.m.	Temperature. 8 p.m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a.m.	Dew-point. 8 p.m.	Relative humidity. 8 a.m.	Relative humidity. 8 p.m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	25.76	.92	4.6	9.7	7.2	49	—23	14.6	—0.3	—1	2	81	73	.61	.32	3.7
Feb	25.75	1.08	12.9	19.7	16.8	57	—29	24.1	9.4	3	9	68	65	.82	.30	3.9
Mar	25.74	.93	31.0	39.0	35.3	59	4	42.4	28.2	22	21	71	51	.96	.58	4.7
Apr	25.83	.68	36.3	52.6	45.6	78	20	56.8	34.5	22	16	60	29	.25	.11	5.2
May	25.80	.76	46.6	59.7	54.0	82	32	63.6	44.3	32	26	59	37	1.48	.36	6.3
June	25.84	.56	51.6	64.5	58.9	91	40	69.9	47.0	37	33	58	35	1.83	.60	5.9
July*	25.86	.55	60.3	79.0	70.6	96	48	83.5	57.8	36	28	42	20	.58	.18	3.7
Aug†	25.89	.50	55.3	74.9	66.8	91	45	79.4	54.3	34	26	48	20	.23	.18	4.4
Sept	25.90	.46	46.5	64.2	57.4	84	28	69.8	45.0	29	26	55	29	.58	.28	4.1
Oct	25.87	.64	40.1	49.5	46.2	69	26	54.8	37.6	22	20	50	36	.55	.25	6.0
Nov	26.00	.75	31.3	41.0	37.4	66	9	46.4	28.4	18	19	61	45	.14	.08	3.1
Dec	25.86	.88	26.0	31.9	30.2	54	2	36.8	23.5	17	18	71	60	.82	.49	6.3
Means	25.84	.73	36.9	48.8	43.9	96	—29	53.5	31.2	23	20	60	42	8.80	......	4.7

* One 8 a. m. observation missed.
† Three 8 a. m. observations and one 8 p. m. observation missed.

HURON, S. DAK.

[Lat., 44° 21′ N.; Long., 98° 9′ W.]

Jan	28.74	1.30	—2.0	6.3	2.6	43	—28	11.6	—6.3	—6	0	83	75	.66	.30	4.3
Feb	28.67	1.16	7.2	16.1	13.0	45	—24	23.1	2.9	2	8	78	71	.18	.10	5.2
Mar	28.65	1.14	18.6	28.7	25.0	50	—15	34.6	15.4	12	19	74	69	.32	.10	6.2
Apr	28.62	1.06	39.9	57.4	49.5	84	17	63.7	35.3	30	33	68	43	.64	.40	4.0
May	28.47	.82	46.5	62.6	54.0	92	23	68.1	39.8	36	36	68	41	2.68	.60	5.0
June	28.47	.78	62.8	74.9	69.2	94	45	81.1	57.2	57	59	83	59	5.87	1.60	4.9
July	28.54	.69	65.5	81.0	73.8	103	47	87.9	59.6	57	58	76	49	1.41	1.10	3.7
Aug	28.59	.75	57.8	76.3	68.0	102	35	83.2	52.7	49	50	74	43	.73	.21	4.4
Sept	28.62	.93	48.3	65.4	60.2	94	25	75.7	44.6	42	40	79	42	.32	.13	3.5
Oct	28.54	.87	37.0	50.1	46.8	79	14	59.9	33.7	30	32	78	54	.61	.23	4.4
Nov	28.70	1.06	25.1	35.5	34.6	70	0	47.6	21.6	19	24	77	66	.38	.36	3.0
Dec	28.67	.84	18.0	25.7	24.4	54	—16	36.1	12.6	10	14	78	63	.68	.42	3.4
Means	28.61	.95	35.4	48.3	43.4	103	—28	56.0	30.8	28	31	76	56	14.68	......	4.3

INDIANAPOLIS, IND.

[Lat., 39° 46′ N.; long., 86° 10′ W.]

Jan	29.37	1.19	35.1	40.2	37.4	70	4	44.5	30.3	30	33	82	77	10.20	4.41	6.8
Feb	29.24	1.01	32.2	41.6	38.8	69	14	45.3	32.2	30	31	82	76	5.28	2.35	7.1
Mar	29.24	1.23	31.4	38.4	36.1	64	8	43.3	28.0	23	26	72	63	4.46	1.71	7.7
Apr	29.27	.97	48.6	56.9	53.7	78	29	63.1	44.8	36	41	65	58	4.58	1.51	6.6
May	29.12	.69	57.9	63.9	61.6	87	39	70.5	52.7	48	46	70	55	8.61	1.07	5.7
June	29.19	.54	72.9	78.3	76.7	97	60	86.6	66.8	62	63	70	62	4.45	1.69	6.5
July	29.22	.47	71.0	79.0	75.6	97	52	87.2	64.1	58	56	65	47	.97	.48	4.8
Aug	29.26	.50	66.4	72.7	71.1	96	46	80.7	61.5	58	56	74	58	6.00	1.94	5.5
Sept	29.29	.47	58.6	64.8	62.9	89	40	71.2	54.6	53	53	81	68	7.31	3.25	6.6
Oct	29.16	.70	50.1	55.8	55.1	84	33	62.8	47.4	44	44	81	67	4.02	.83	6.7
Nov	29.28	.65	41.4	47.1	46.5	68	27	54.1	38.9	34	35	76	69	3.36	1.58	6.8
Dec	29.29	.72	29.0	34.3	33.1	52	12	39.2	27.1	21	24	74	67	1.64	.40	6.3
Means	29.24	.76	49.8	56.1	54.0	97	4	62.4	45.7	41	43	74	63	54.87	......	6.2

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

HELENA, MONT.

[H=4,060. T=63.75. h=50.64.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	3.4	30	W.	SW.	5	3	0	1	1	16	10	14	12	17	10	4	9	22	30	0	0	0
Feb	6.1	60	W.	NW.	0	6	0	0	0	13	12	18	7	13	12	3	6	13	20	0	0	0
Mar	7.6	36	NW.	W.	0	5	0	1	1	19	23	12	1	11	16	4	8	6	18	0	0	0
Apr	6.3	30	NW.	W.	1	8	0	4	0	13	14	10	10	11	8	11	6	0	11	0	0	0
May	8.0	36	W.	W.	10	10	1	1	0	14	15	5	6	8	7	16	17	0	2	0	1	0
June	7.6	40	SW.	SW.	1	2	1	0	3	26	19	2	6	6	11	13	19	0	0	1	1	0
July	6.8	48	SW.	W.	3	4	0	0	5	15	24	5	5	10	6	6	8	0	0	8	2	0
Aug	6.8	42	SW.	SW.	2	2	2	2	0	24	17	5	5	12	11	8	4	0	0	1	0	0
Sept	6.3	36	W.	SW.	0	2	0	0	1	26	9	2	11	13	8	9	6	0	3	0	0	0
Oct	8.0	36	SW.	SW.	4	2	1	2	3	31	14	1	4	7	12	12	7	0	4	0	1	0
Nov	5.2	34	SW.	SW.	1	0	0	0	4	35	2	5	13	18	8	4	4	2	22	0	0	0
Dec	5.0	60	W.	SW.	1	1	0	0	2	25	21	4	8	10	12	9	12	8	20	0	0	0
Means	6.4	....	......	SW.	37	45	5	11	20	257	180	83	88	145	121	99	106	51	139	10	5	0

HURON, S. DAK.

[H=1,307. T=47. h=39.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan	9.4	38	SE.	NW.	5	3	0	15	7	3	6	23	0	13	12	6	8	27	31	0	0	0
Feb	11.8	46	NW.	N.	18	0	3	11	6	3	1	13	1	7	12	9	4	18	28	0	0	0
Mar	11.0	45	NW.	NW.	14	2	2	18	3	2	2	19	0	5	16	10	11	12	29	0	0	0
Apr	10.8	40	S.	SE.	13	4	1	21	6	2	4	7	2	16	8	6	6	0	13	0	0	0
May	11.8	50	N.	NW.	5	11	1	10	5	4	4	21	1	10	14	7	14	0	4	1	2	0
June	9.4	60	N.	SE.	9	5	3	25	9	1	3	4	1	8	17	5	13	0	0	3	13	0
July	8.7	36	S.	SE.	18	3	1	23	7	0	2	5	3	15	13	3	7	0	0	13	5	2
Aug	11.2	42	NW.	N.	16	1	0	16	18	5	1	10	0	14	13	4	9	0	0	8	6	2
Sept	12.2	38	NW.	SE.	8	4	1	20	7	3	5	12	0	16	10	4	5	0	2	1	2	2
Oct	11.7	42	NW.	SE.	12	1	2	17	3	6	6	15	0	11	16	4	6	0	12	0	0	0
Nov	9.4	34	NW.	S.	11	2	1	4	15	5	8	14	0	18	9	3	3	6	27	0	0	4
Dec	9.9	48	NW.	S.	4	5	4	9	15	3	8	14	0	18	10	3	4	12	30	0	0	0
Means	10.6	....	......	SE.	133	41	19	189	96	37	50	157	8	151	150	64	90	75	176	26	28	10

INDIANAPOLIS, IND.

[H=706. T=76.4. h=72.3.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan	7.5	30	NW.	SW.	5	4	3	11	11	12	10	6	0	5	12	14	20	6	15	0	0	0
Feb	6.7	30	NW.	SE.	4	3	5	12	5	12	4	11	0	7	8	18	16	5	12	0	3	0
Mar	7.9	32	W.	W.	4	8	7	5	7	6	14	11	0	2	12	17	19	5	16	0	2	0
Apr	6.9	34	W.	NE.	1	12	8	11	11	6	6	5	0	10	9	11	14	0	1	0	1	0
May	5.6	30	SW.	SE.	4	7	1	13	8	12	7	10	0	7	13	11	19	0	0	0	8	0
June	4.6	28	NW.	SW.	3	4	11	5	10	19	3	2	3	0	23	7	18	0	0	9	9	0
July	4.4	31	NE.	SW.	6	8	7	8	7	9	5	9	3	11	17	3	10	0	0	10	5	0
Aug	4.4	20	NW.	S.	12	6	6	6	13	5	4	9	1	11	8	12	17	0	0	4	5	0
Sept	4.6	23	NW.	NE.	5	14	4	10	8	5	4	6	4	5	13	12	16	0	0	0	1	0
Oct	5.5	26	SW.	NW.	1	5	2	8	10	10	10	14	2	4	12	15	20	0	0	0	1	0
Nov	5.7	22	NW.	SW.	3	8	3	6	11	12	6	9	2	10	9	11	10	0	4	0	0	0
Dec	7.4	23	W.	S.	6	8	4	4	12	8	8	10	2	5	13	18	10	9	24	0	0	0
Means	5.9	....	......	SW.	54	87	61	99	113	116	81	102	17	77	144	144	189	25	72	23	35	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

JACKSONVILLE, FLA.

[Lat., 30° 20′ N.; long., 81° 39′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	30.26	.38	56.3	62.7	63.4	80	40	72.9	53.8	54	59	93	88	.63	.30	5.2
Feb	30.11	.47	58.3	64.4	64.8	83	44	74.1	55.6	55	57	89	78	.51	.33	4.5
Mar	30.11	.50	53.9	61.2	60.2	85	27	70.2	50.2	47	50	80	69	2.80	.76	4.1
Apr	30.12	.58	66.0	69.4	69.8	88	47	79.1	60.4	58	57	75	67	.95	.53	3.9
May	29.97	.47	71.9	73.3	74.4	89	53	83.2	65.5	64	64	76	72	9.20	3.71	4.5
June	30.04	.40	78.5	79.5	81.8	97	66	91.1	72.6	71	70	78	74	1.80	.80	4.6
July	30.02	.49	78.7	78.3	81.0	96	66	89.5	72.5	72	71	79	78	9.70	2.45	5.0
Aug	30.04	.37	77.5	78.5	80.4	94	64	88.7	72.1	71	70	81	76	4.26	1.63	4.5
Sept	30.01	.32	75.4	76.7	79.1	92	65	87.2	71.0	71	71	87	83	4.88	.97	5.3
Oct	29.98	.41	65.9	70.4	71.3	90	43	79.9	62.7	61	62	83	75	9.07	5.15	4.3
Nov	30.10	.40	59.0	64.8	65.6	84	39	75.1	56.2	54	58	86	78	2.26	1.44	3.6
Dec	30.14	.50	48.9	56.1	55.9	80	30	66.1	45.7	44	47	84	73	1.37	.66	4.4
Means	30.08	.44	65.9	69.6	70.6	97	27	79.8	61.5	60	61	83	76	47.52	......	4.5

JUPITER, FLA.

[Lat., 26° 57′ N.; long., 80° 7′ W.]

Jan	30.23	.20	70.8	72.4	72.2	80	58	77.5	66.8	63	63	76	73	2.41	1.74	5.0
Feb	30.12	.28	68.8	70.7	70.2	84	54	77.3	63.2	62	62	79	76	2.00	1.10	4.9
Mar	30.10	.39	66.5	68.2	67.8	86	33	76.1	59.5	58	59	76	72	2.44	1.60	5.7
Apr	30.14	.42	73.5	72.8	73.2	86	54	79.9	66.6	63	63	72	72	1.13	.55	5.7
May	30.00	.43	77.7	75.4	76.0	88	62	81.9	70.0	71	70	81	82	13.51	4.85	7.0
June	30.07	.29	82.3	79.0	80.4	95	71	87.0	73.7	75	73	78	82	2.51	1.55	4.4
July	30.05	.34	82.3	79.4	80.8	94	70	86.8	74.7	75	74	79	84	6.92	2.20	6.8
Aug	30.05	.29	82.0	80.4	80.4	90	69	86.3	74.4	75	74	80	82	8.70	2.30	6.2
Sept	30.01	.25	80.4	78.5	79.0	89	69	85.3	72.8	75	74	83	85	8.69	2.12	6.0
Oct	29.99	.24	75.5	76.0	75.6	89	48	82.9	68.4	69	69	82	78	5.43	2.39	4.4
Nov	30.05	.46	73.9	74.4	73.7	83	53	78.6	68.8	66	65	78	74	4.95	2.70	6.8
Dec	30.13	.37	62.0	64.9	64.7	82	44	72.0	57.4	57	59	83	81	2.66	2.05	4.1
Means	30.08	.33	74.6	74.3	74.5	95	33	81.0	68.0	67	67	79	78	61.35	......	5.5

KANSAS CITY, MO.

[Lat., 39° 5′ N.; long., 94° 37′ W.]

Jan	29.12	1.07	26.6	31.9	30.2	68	−5	39.4	20.9	22	25	82	76	1.40	.83	6.0
Feb	29.03	.96	29.6	36.6	34.0	71	0	41.6	26.4	24	25	79	65	.53	.31	6.2
Mar	29.04	1.33	31.5	41.7	38.3	73	5	47.9	28.7	23	26	73	58	1.15	.48	5.6
Apr	29.01	.90	50.0	60.8	57.0	89	30	66.5	47.6	42	42	77	55	2.61	.95	6.5
May	28.90	.65	56.9	67.5	63.6	87	36	73.8	53.3	48	49	72	53	3.31	1.70	5.4
June	28.93	.63	70.8	82.1	77.0	97	55	86.7	67.4	62	62	74	52	1.94	.92	4.0
July	28.98	.32	73.2	86.3	80.5	102	59	91.2	69.8	64	62	74	46	1.96	1.22	3.6
Aug	29.02	.39	66.4	78.1	73.7	97	56	83.3	64.1	60	62	80	60	6.60	1.86	3.9
Sept	29.07	.67	56.2	66.3	63.2	87	39	72.6	53.9	52	55	88	68	3.85	1.57	5.6
Oct	28.98	.71	47.9	59.4	56.2	82	30	65.9	46.5	42	45	81	62	5.08	3.40	4.6
Nov	29.11	.91	38.7	49.1	46.4	75	24	55.9	37.0	32	36	78	64	2.67	1.24	4.1
Dec	29.12	1.14	31.2	40.3	37.4	68	14	45.7	29.1	22	26	71	60	.03	.58	4.1
Means	29.03	.81	48.2	58.3	54.8	102	−5	64.2	45.4	41	43	77	60	31.82	......	5.0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

JACKSONVILLE, FLA.

[H=43. T=69. h=56.5.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	6.6	29	NE.	NE.	14	15	3	12	4	5	5	3	1	12	12	7	9	0	0	0	0	0
Feb	7.6	36	W.	N.	12	9	4	10	8	8	2	3	0	13	9	6	6	0	0	0	0	0
Mar	8.5	37	SW.	SE.	9	3	3	18	4	9	6	10	0	15	12	4	10	0	4	0	2	0
Apr	8.5	29	SW.	NE.	2	16	4	11	5	6	11	3	2	15	11	4	8	0	0	0	1	0
May	8.0	31	SW.	S.	4	7	10	8	14	12	6	1	0	15	7	9	16	0	0	0	5	0
June	6.4	32	NE.	SW.	0	1	8	8	4	23	11	5	0	10	18	2	14	0	0	19	12	0
July	6.4	30	SE.	W.	1	2	9	9	16	9	16	0	0	9	17	5	24	0	0	17	7	0
Aug	5.7	25	S.	SE.	6	8	12	17	5	8	5	0	1	12	15	4	14	0	0	12	5	0
Sept	4.7	28	SW.	SE.	4	7	9	20	6	9	4	1	0	7	18	5	20	0	0	4	2	0
Oct	5.7	28	W.	N.	13	8	7	4	4	8	10	8	0	17	4	10	11	0	0	0	1	0
Nov	5.0	24	W.	NE.	16	21	6	4	2	3	4	4	0	16	11	3	6	0	0	0	0	0
Dec	6.6	40	W.	W.	10	11	1	4	4	2	16	12	2	14	11	6	6	0	1	0	0	0
Means	6.6	....	......	SE.	91	108	76	125	76	102	96	50	6	155	145	65	144	0	5	52	35	0

JUPITER, FLA.

[H=28. T=13.4. h=1.4.]

Jan	10.5	36	NE.	E.	2	12	29	9	2	1	1	6	0	8	19	4	10	0	0	0	0	0
Feb	7.6	24	SE.	S.	4	5	8	8	14	4	4	8	1	10	12	6	9	0	0	0	1	0
Mar	11.0	30	S.	SE.	3	6	6	16	12	2	5	12	0	10	9	12	8	0	0	0	2	0
Apr	10.6	36	E.	E.	1	9	18	7	10	8	3	3	1	7	15	8	7	0	0	0	2	0
May	8.2	32	SE.	SE.	7	6	11	11	9	5	6	3	4	0	15	15	16	0	0	0	9	0
June	6.1	24	NE.	SE.	0	4	9	19	14	9	3	0	2	10	18	2	5	0	0	5	3	0
July	7.1	24	W.	E.	0	0	15	14	12	12	4	3	2	0	23	8	17	0	0	2	13	0
Aug	6.8	25	W.	E.	2	2	28	16	2	4	3	4	1	7	18	6	16	0	0	0	11	0
Sept	5.7	30	E.	E.	4	5	22	10	6	0	2	5	6	7	16	7	23	0	0	0	13	0
Oct	6.1	24	NE.	S.	8	7	8	4	10	3	9	9	4	15	13	3	9	0	0	0	2	0
Nov	11.2	36	NW.	E.	4	21	24	0	3	0	3	5	0	2	15	13	8	0	0	0	2	0
Dec	9.0	25	NW.	NW.	7	10	2	5	3	3	14	18	0	13	15	3	9	0	0	0	0	0
Means	8.3	....	......	E.	42	87	180	119	97	51	57	76	21	87	189	87	137	0	0	7	58	0

KANSAS CITY, MO.

[H=963. T=78. h=81.]

Jan	8.4	36	SE.	NW.	9	6	4	11	10	6	3	13	0	8	11	12	12	10	20	0	0	0
Feb	8.7	28	S.	S.	10	9	2	6	13	1	3	12	0	7	9	12	9	5	18	0	1	0
Mar	8.8	33	SW.	N.	19	7	6	9	6	4	2	9	0	7	16	8	8	5	16	0	2	0
Apr	9.6	38	S.	S.	7	11	9	6	12	6	3	4	2	7	10	13	10	0	1	0	1	0
May	8.8	34	N.	S.	14	4	4	2	19	4	3	11	1	8	15	8	13	0	0	0	6	0
June	8.6	30	S.	S.	6	5	1	0	26	10	6	5	1	14	12	4	7	0	0	13	6	0
July	7.6	28	E.	S.	5	6	9	10	20	6	1	2	3	17	12	2	4	0	0	16	8	0
Aug	6.1	30	S.	SE.	7	15	5	16	9	7	1	1	1	12	16	3	14	0	0	6	11	0
Sept	6.9	38	NW.	NE.	11	20	3	4	15	1	3	1	2	6	16	8	9	0	0	0	4	0
Oct	7.6	30	N.	S.	9	5	3	6	14	5	7	8	5	13	8	10	8	0	1	0	5	0
Nov	7.5	25	N.	SW.	14	5	1	2	6	16	8	4	4	14	9	7	7	0	7	0	1	0
Dec	9.0	38	NW.	SW.	10	8	5	3	13	10	4	9	0	17	6	8	4	5	19	0	1	0
Means	8.1	....	......	S.	121	101	52	75	163	76	44	79	19	130	140	95	105	25	82	35	46	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

KEELER, CAL.

[Lat., 36° 35′ N.; long., 117° 51′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a. m.	Dew-point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	*In.*	*In.*	°	°	°	°	°	°	°	°	°	%	%	*In.*	*In.*	
Jan	26.31	.68	30.5	40.0	36.0	59	16	42.5	26.8	18	21	60	47	.42	.42	2.1
Feb	26.31	.92	36.4	48.4	42.1	67	19	52.4	31.8	21	22	52	35	.01	.01	1.5
Mar	26.31	.77	44.0	59.1	52.0	74	28	63.2	40.7	26	24	47	26	T.	T.	2.7
Apr	26.28	.63	51.0	68.7	59.4	80	35	71.7	47.1	30	32	45	26	.10	.08	2.0
May	26.22	.54	59.8	77.5	69.0	94	39	81.3	56.7	35	39	40	27	.20	.14	2.2
June	26.24	.40	62.8	84.0	73.2	96	46	86.7	59.8	35	37	34	19	.00	.00	.9
July	26.20	.40	74.3	93.5	85.0	103	66	97.4	72.5	41	50	30	22	T.	T.	1.4
Aug	26.29	.32	71.0	87.5	80.1	98	59	91.5	68.7	40	48	43	27	1.71	1.20	2.8
Sept	26.31	.50	65.5	79.5	73.2	97	50	83.5	63.0	42	44	44	33	.93	.50	3.8
Oct	26.34	.84	53.3	66.9	60.4	80	38	71.1	49.8	30	31	41	30	.03	.03	1.0
Nov	26.45	.78	45.0	56.6	51.2	77	38	61.7	40.6	20	23	49	29	.12	.12	1.8
Dec	26.42	.78	38.6	45.4	42.5	61	29	50.5	34.5	25	26	60	49	.22	.18	4.5
Means	26.31	.63	52.7	67.3	60.3	103	16	71.4	49.3	31	33	45	31	3.74	......	2.1

KEOKUK, IOWA.

[Lat., 40° 22′ N.; long., 91° 26′ W.]

Jan	29.53	1.17	26.1	31.0	29.4	64	—5	38.3	20.4	22	27	86	85	1.81	.98	4.9
Feb	29.44	.96	28.5	34.2	32.8	67	—1	40.8	24.9	24	27	84	77	1.09	.40	6.2
Mar	29.45	1.35	26.6	36.4	32.6	67	—6	41.6	23.6	21	27	79	71	2.43	.92	5.0
Apr	29.42	1.02	48.2	58.3	54.7	84	27	64.9	44.5	30	43	71	60	1.79	.88	4.7
May	29.28	.64	55.0	63.9	60.0	90	35	70.4	49.7	46	50	74	62	3.84	.88	4.5
June	29.31	.64	71.5	80.0	76.2	98	53	85.8	66.6	63	65	76	61	3.41	.94	4.4
July	29.36	.41	71.7	82.6	78.0	104	54	89.1	67.0	60	61	68	50	2.40	2.08	3.2
Aug	29.41	.47	64.8	75.6	71.2	98	49	81.5	60.9	56	56	75	53	1.77	.92	4.0
Sept	29.46	.74	55.8	66.0	62.7	92	36	73.1	52.3	50	52	82	62	4.46	1.84	4.3
Oct	29.35	.84	47.1	56.5	54.1	86	22	63.0	45.2	42	44	84	64	2.44	1.08	4.9
Nov	29.48	.81	37.7	46.2	44.2	77	26	52.9	35.4	31	34	80	65	1.87	.61	4.6
Dec	29.50	.96	28.6	35.8	33.8	57	13	41.7	25.8	21	24	73	66	.03	.02	4.2
Means	29.42	.83	46.8	55.5	52.5	104	—6	61.9	43.0	40	42	78	65	26.93	......	4.6

KEY WEST, FLA.

[Lat., 24° 34′ N.; long., 81° 49′ W.]

Jan	30.20	.15	72.3	73.6	73.4	80	65	77.2	69.6	67	67	84	80	1.06	.27	4.3
Feb	30.11	.27	72.7	73.0	73.3	80	65	77.4	69.2	67	67	83	81	2.38	1.44	4.1
Mar	30.10	.87	70.4	70.9	70.6	82	48	75.4	65.8	65	64	82	79	2.17	1.61	3.7
Apr	30.13	.31	75.2	74.6	75.2	83	66	79.6	70.9	65	65	72	73	1.11	1.11	4.0
May	30.00	.39	78.6	78.6	78.8	87	60	83.0	74.6	71	73	77	80	3.84	1.18	5.5
June	30.08	.28	82.2	81.3	81.4	89	70	85.7	77.0	72	74	72	78	3.33	1.90	4.7
July	30.06	.24	82.6	83.3	82.2	89	69	87.0	77.4	73	74	74	77	3.70	.83	5.8
Aug	30.04	.24	82.2	82.1	81.8	89	70	86.9	76.7	72	74	73	78	2.25	.67	5.8
Sept	30.01	.23	80.9	81.0	80.3	89	70	86.2	74.4	73	74	79	81	16.14	2.53	6.1
Oct	30.00	.20	79.1	79.4	79.6	88	64	83.8	75.4	70	71	73	70	1.86	.62	3.9
Nov	30.04	.36	74.2	75.3	74.8	83	65	78.9	71.2	68	69	83	82	4.07	1.53	5.8
Dec	30.15	.30	67.0	68.8	68.2	80	56	71.7	64.6	60	61	79	77	.86	.36	3.2
Means	30.08	.28	76.4	76.7	76.6	89	48	81.0	72.2	69	69	78	78	42.87	......	4.7

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

KEELER, CAL.

[H=3,622. T=20. h=19.8]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	7.5	40	NW.	S.	7	7	1	11	11	1	3	8	13	21	9	1	2	0	22	0	0	0
Feb	9.4	48	NW.	SE.	7	2	4	12	9	3	2	7	10	25	3	0	1	0	18	0	0	0
Mar	9.7	46	NW.	S.	7	2	5	8	15	6	1	10	8	18	12	1	0	0	2	0	0	0
Apr	7.7	88	NE.	SW.	6	4	5	11	8	12	4	8	2	21	9	0	2	0	0	0	1	0
May	9.8	84	NW.	S.	8	3	6	10	10	10	3	9	3	22	6	3	2	0	0	6	8	0
June	6.7	36	NW.	NW.	9	2	7	8	9	6	6	11	2	29	1	0	0	0	0	8	1	0
July	5.9	84	S.	S.	9	2	9	6	17	7	6	3	3	27	8	1	0	0	0	29	1	0
Aug	5.4	42	SE.	E.	4	8	11	8	10	8	4	6	3	20	9	2	4	0	0	21	8	0
Sept	4.9	28	S.	SE.	5	3	11	11	6	7	5	5	7	19	8	3	4	0	0	7	2	0
Oct	4.8	84	NW.	SE.	4	7	10	10	4	8	3	4	17	27	4	0	1	0	0	0	0	0
Nov	5.0	40	SW.	E.	4	6	18	13	4	5	0	4	6	21	8	1	1	0	0	0	0	0
Dec	4.9	44	S.	E.	10	6	17	6	9	4	0	2	8	14	6	11	3	0	5	0	0	0
Means	6.6	....	......	SE.	80	52	104	114	112	72	37	77	82	264	78	28	29	0	42	71	16	0

KEOKUK, IOWA.

[H=613. T=63. h=56.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	6.9	36	S.	NW.	3	3	5	7	9	9	4	20	2	13	5	13	11	11	22	0	0	0
Feb	6.9	26	W.	NW.	9	2	4	7	8	8	6	13	0	8	4	16	8	7	20	0	0	0
Mar	7.4	34	W.	NW.	3	7	6	9	5	8	8	15	1	11	12	8	12	7	21	0	2	0
Apr	7.7	30	S.	E.	5	9	10	5	9	8	3	8	9	12	7	11	10	0	9	0	2	0
May	6.7	24	NW.	S.	4	5	3	5	15	8	9	10	3	16	5	10	12	0	0	1	9	0
June	5.4	40	S.	SW.	1	2	5	6	11	15	9	2	9	12	13	5	9	0	0	11	6	0
July	5.6	36	SW.	E.	8	5	9	6	7	8	5	7	7	19	8	4	6	0	0	15	3	0
Aug	4.8	24	SE.	NW.	8	6	8	9	6	8	2	10	5	14	11	6	11	0	0	3	8	0
Sept	5.1	36	NW.	NE.	9	14	1	7	6	8	2	3	10	13	9	8	8	0	0	1	4	0
Oct	5.7	30	W.	NW.	8	0	4	5	6	8	6	14	10	11	10	10	7	0	2	0	8	0
Nov	5.5	24	W.	SW.	5	6	3	4	5	14	11	10	2	13	10	7	8	0	12	0	0	0
Dec	6.4	36	W.	NW.	4	11	2	6	5	0	5	10	1	15	8	8	2	7	24	0	1	0
Means	6.2	....	......	NW.	62	76	60	76	92	111	70	130	53	157	102	106	101	32	103	81	83	0

KEY WEST, FLA.

[H=22. T=41. h=44.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	12.9	36	NE.	E.	5	10	37	1	0	0	0	0	0	13	15	8	10	0	0	0	0	0
Feb	10.4	37	N.	E.	3	14	20	15	3	0	0	0	1	14	11	3	9	0	0	0	2	0
Mar	11.3	48	NW.	E.	12	14	21	5	4	0	0	4	2	16	13	2	7	0	0	0	0	0
Apr	11.1	32	E.	E.	2	5	30	6	5	0	0	6	0	10	10	4	2	0	0	0	0	0
May	8.7	29	NW.	SE.	4	3	13	23	11	4	1	2	1	11	11	9	12	0	0	0	7	0
June	7.5	24	S.	E.	1	0	25	23	3	2	3	3	0	11	16	3	11	0	0	0	10	0
July	7.8	30	NE.	E.	1	3	20	19	2	6	7	2	2	6	18	7	18	0	0	0	8	0
Aug	7.4	24	N.	E.	1	1	42	8	2	3	1	3	1	9	16	6	13	0	0	0	11	0
Sept	6.1	37	NE.	SE.	2	3	22	24	2	2	1	2	2	4	14	12	23	0	0	0	12	0
Oct	7.5	34	N.	E.	10	11	16	16	3	2	0	2	3	16	13	2	10	0	0	0	8	0
Nov	13.8	52	NW.	E.	5	31	26	4	0	1	0	3	0	10	7	13	11	0	0	0	2	0
Dec	11.1	30	NW.	NE.	9	21	10	7	1	2	3	9	0	19	11	1	1	0	0	0	0	0
Means	9.6	....	......	E.	55	115	288	151	35	22	16	36	12	145	155	65	122	0	0	0	55	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

KNOXVILLE, TENN.

[Lat., 35° 56′ N.; long., 83° 58′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	*In.*	*In.*	°	°		°	°		°	°	°	%	%	*In.*	*In.*	
Jan	29.25	.66	44.2	50.7	48.8	73	24	56.4	41.2	38	42	82	72	4.26	2.08	6.4
Feb	29.08	.67	47.0	53.1	51.8	76	26	60.4	43.3	42	43	84	71	8.12	2.27	6.6
Mar	29.08	.82	40.8	47.4	45.1	76	15	53.7	36.5	33	35	76	66	5.72	1.36	5.7
Apr	29.11	.73	54.9	62.1	59.8	80	35	69.0	50.7	47	47	76	62	4.10	1.18	5.3
May	28.98	.57	60.9	68.5	66.3	88	37	76.6	56.0	54	25	80	65	4.34	1.11	4.5
June	29.06	.40	71.7	78.6	77.5	93	58	88.1	66.9	66	66	82	67	2.80	.77	4.8
July	29.05	.46	72.3	77.6	78.0	95	62	87.4	68.5	66	67	81	70	3.42	2.34	4.6
Aug	29.09	.34	68.7	74.3	73.8	92	53	82.6	65.1	64	65	85	73	4.39	1.43	5.7
Sept	29.08	.30	65.1	71.1	70.6	90	53	78.8	62.5	62	64	90	79	3.83	.76	6.3
Oct	29.02	.75	51.1	57.8	57.0	81	32	65.0	48.9	48	50	90	77	3.69	1.45	4.8
Nov	29.14	.53	43.1	55.4	52.4	76	26	63.5	41.2	39	41	86	60	.17	.10	3.3
Dec	29.13	.67	34.7	42.6	40.2	60	23	47.8	32.5	30	32	82	70	4.66	1.39	5.0
Means	29.09	.58	54.5	61.6	60.1	95	15	69.1	51.1	49	51	83	60	40.59	......	5.2

LANSING, MICH.

[Lat., 42° 44′ N.; long., 84° 32′ W.]

Jan	29.18	1.20	28.3	31.4	31.2	63	1	38.8	23.6	25	28	89	88	2.97	.85	7.5
Feb	29.10	.98	27.5	31.6	31.0	61	10	37.5	24.5	24	27	86	83	1.84	.55	6.4
Mar	29.11	1.19	24.5	29.3	28.2	51	— 3	35.4	21.1	20	22	81	76	1.40	.51	6.0
Apr	29.17	1.26	41.9	49.6	46.6	75	20	57.6	35.7	33	34	72	59	3.20	.75	4.3
May	28.99	.82	50.0	54.7	53.8	84	30	63.3	44.2	42	42	74	64	5.53	1.68	5.8
June	29.06	.63	68.2	72.8	71.2	94	40	82.7	59.8	58	60	70	65	3.70	1.32	4.2
July	29.09	.58	68.2	74.4	71.6	94	44	83.8	59.5	54	54	62	50	.75	.49	3.1
Aug	29.14	.55	61.5	67.6	65.4	96	40	76.6	54.3	53	52	74	60	3.02	1.74	5.0
Sept	29.20	.71	53.4	59.2	58.3	89	32	69.3	47.3	47	48	78	69	2.12	.91	4.9
Oct	29.01	.90	45.1	48.9	49.4	76	56	57.2	41.5	41	42	86	77	4.66	1.09	7.1
Nov	29.11	.75	35.4	39.0	39.3	62	21	46.7	31.9	30	30	82	70	2.71	1.41	6.5
Dec	29.12	.97	24.0	27.2	26.4	47	10	32.9	20.0	20	20	87	74	.95	.25	6.3
Means	29.11	.88	44.0	48.8	47.7	96	— 3	56.8	38.6	37	38	79	70	32.85	......	5.6

LA CROSSE, WIS.

[Lat., 43° 49′ N.; long., 91° 15′ W.]

Jan	29.37	1.28	13.6	19.5	16.8	48	—23	24.8	8.8	11	14	89	78	1.57	.58	5.7
Feb	29.28	1.00	18.8	27.1	23.8	53	— 5	31.4	16.1	15	18	84	70	.80	.27	5.6
Mar	29.30	1.08	17.8	29.1	25.0	50	—18	34.3	15.8	12	19	79	68	.63	.27	5.0
Apr	29.30	1.02	42.2	54.1	49.8	81	21	60.1	39.4	31	31	66	45	1.77	.96	4.3
May	29.12	.80	48.0	58.3	53.4	83	29	63.4	43.5	38	40	72	55	4.20	.88	6.1
June	29.17	.76	66.8	74.0	71.3	95	50	80.3	62.3	60	62	80	70	8.91	1.93	6.0
July	29.22	.51	67.7	76.9	73.2	97	52	82.9	63.5	59	61	75	59	1.46	.75	4.0
Aug	29.28	.52	59.8	70.1	66.2	96	43	76.6	55.9	51	54	81	60	3.47	1.24	4.8
Sept	29.32	.84	49.9	61.1	58.2	88	31	69.5	46.8	46	50	86	58	5.20	1.90	4.5
Oct	29.18	1.03	43.0	50.3	48.8	74	23	57.2	40.4	39	41	88	73	5.14	1.22	7.1
Nov	29.30	.84	31.8	39.3	37.6	60	17	45.5	29.6	27	32	83	77	1.24	.66	4.7
Dec	29.32	.90	21.3	28.1	26.5	52	2	35.0	18.1	16	20	79	73	.38	.20	4.8
Means	29.26	.88	40.1	49.0	45.9	97	—23	55.1	36.7	34	37	80	66	34.77	......	5.2

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

KNOXVILLE, TENN.

[H=980. T=79.5. h=7.07.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	6.4	36	SW.	SW.	7	8	15	1	4	17	7	1	2	5	14	12	12	0	7	0	0	0
Feb	7.7	36	SW.	SW.	8	12	4	3	1	21	3	4	0	6	8	14	15	0	5	0	1	0
Mar	7.8	48	SW.	SW.	12	6	9	4	5	14	6	6	0	10	8	13	15	3	11	0	3	0
Apr	7.1	28	SW.	SW.	10	8	8	1	1	20	9	2	1	10	8	12	12	0	0	0	0	0
May	5.2	25	SW.	SW.	9	5	10	6	4	18	5	2	3	13	9	9	15	0	0	0	2	0
June	4.6	36	NW.	SW.	5	8	9	5	2	18	11	1	1	7	21	2	11	0	0	8	5	0
July	4.9	20	SW.	SW.	12	7	11	4	5	16	4	2	1	13	12	6	12	0	0	8	4	0
Aug	4.8	22	SW.	SW.	10	14	5	2	4	23	3	1	0	9	10	12	15	0	0	3	2	0
Sept	4.1	16	SW.	NE.	9	17	11	5	4	4	5	0	5	6	11	13	13	0	0	0	2	0
Oct	4.8	25	SW.	W.	8	11	4	0	0	12	13	4	10	10	15	6	14	0	1	0	0	0
Nov	4.1	40	SW.	E.	7	6	12	1	5	4	11	3	11	16	11	3	2	0	3	0	0	0
Dec	5.6	21	SW.	NE.	6	16	10	0	2	8	12	6	2	13	7	11	10	0	10	0	0	0
Means	5.6	....	.....	SW.	103	118	108	32	37	175	89	32	36	118	134	113	146	3	42	19	19	0

LANSING, MICH.

[H=833. T=44. h=41.]

Jan	8.2	42	SW.	NW.	0	0	4	10	9	12	8	14	5	3	10	18	17	10	24	0	0	0
Feb	8.2	30	SW.	NW.	1	9	5	9	6	10	2	14	0	6	11	11	14	8	22	0	1	0
Mar	8.1	36	SW.	NW.	6	7	0	10	2	11	7	17	2	7	11	13	14	11	26	0	1	0
Apr	8.2	27	NW.	NE.	3	15	1	13	5	12	1	9	1	13	8	9	12	0	9	0	8	0
May	8.0	28	W.	SW.	1	12	0	12	4	17	6	10	0	7	13	11	19	0	3	0	4	0
June	5.7	28	SW.	SW.	1	8	2	15	6	15	2	10	1	12	15	3	12	0	0	4	8	0
July	5.8	24	SW.	SW.	8	7	0	8	7	19	2	10	1	16	15	0	4	0	0	7	3	0
Aug	5.4	32	W.	NW.	4	10	4	9	7	9	3	13	3	10	12	9	10	0	0	2	3	0
Sept	5.5	25	SW.	NE.	7	15	5	4	13	5	4	5	2	10	10	10	9	0	0	0	4	0
Oct	5.0	27	SW.	SW.	8	1	9	3	7	11	7	9	7	6	8	17	16	0	3	0	4	0
Nov	7.2	25	SW.	SW.	3	4	6	8	12	13	11	8	0	7	9	14	8	1	14	0	0	0
Dec	7.5	36	SW.	SW.	7	7	2	6	6	18	5	11	0	7	9	15	8	14	29	0	0	0
Means	6.9	....	.....	SW.	49	95	38	102	84	152	58	130	22	104	131	130	143	44	130	13	31	0

LA CROSSE, WIS.

[H=736. T=70. h=61.4.]

Jan	6.5	25	NW.	NW.	6	5	1	8	12	6	5	20	4	0	17	8	9	20	30	0	0	0
Feb	8.0	29	NW.	NW.	6	1	4	4	13	0	7	17	4	11	9	8	10	11	25	0	0	0
Mar	6.8	29	W.	NW.	10	2	0	6	12	4	9	15	4	9	15	7	10	10	27	0	0	0
Apr	8.3	29	NW.	S.	13	4	4	9	21	1	1	7	0	13	11	6	9	0	3	0	2	0
May	6.9	45	SE.	S.	10	8	2	10	15	1	7	5	4	4	18	9	14	0	2	0	5	0
June	5.0	28	N.	S.	9	0	1	8	16	7	6	3	10	9	9	12	18	0	0	4	9	0
July	6.2	42	W.	S.	9	2	2	10	18	5	4	5	7	16	9	6	7	0	0	4	4	0
Aug	4.8	40	N.	S.	11	1	2	6	16	2	2	6	16	12	9	10	12	0	0	1	2	0
Sept	5.4	30	NW	S.	7	1	1	7	26	3	3	4	8	16	3	11	9	0	1	0	1	0
Oct	5.0	31	W.	SE.	13	3	1	13	3	6	6	5	12	6	6	19	15	0	8	0	0	0
Nov	5.2	23	N.	S.	11	3	0	4	21	0	8	6	7	10	14	6	5	1	19	0	0	0
Dec	5.7	30	W.	S.	5	2	0	5	16	5	7	11	11	13	8	10	4	11	27	0	0	0
Means	6.1	....	.....	S.	110	32	18	85	189	40	65	104	87	125	128	112	122	53	137	9	23	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

LEAVENWORTH, KANS.

[Lat., 39° 19′ N.; long., 94° 57′ W.]

Months and year.	Pressure (actual).		Temperature.					Mean.		Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Maximum.	Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.29	1.10	24.4	29.6	28.1	67	−6	38.1	18.1	20	22	84	76	1.27	.40	6.1
Feb	29.21	.97	27.4	35.4	32.3	70	−3	40.5	24.1	24	27	86	74	.54	.25	6.6
Mar	20.21	1.35	30.2	40.7	37.5	76	0	47.5	27.5	26	28	84	65	1.00	.35	6.5
Apr	29.18	.92	50.0	60.2	56.5	90	29	66.6	46.6	44	46	80	64	2.23	.63	6.7
May	29.04	.65	57.2	67.1	63.0	88	36	73.9	52.0	51	56	79	67	4.10	1.61	6.5
June	29.06	.65	71.5	81.5	77.0	97	61	87.2	66.9	65	68	81	65	1.93	1.03	5.6
July	29.10	.33	73.5	86.0	80.6	102	58	91.8	69.5	65	65	76	52	1.61	.86	5.5
Aug	29.15	.42	66.8	77.9	74.2	98	55	81.3	64.0	62	64	84	65	5.85	2.70	6.3
Sept	29.20	.70	56.5	66.2	61.0	88	37	74.0	53.9	52	56	85	72	3.81	1.67	6.9
Oct	29.11	.72	47.3	58.1	55.8	79	29	66.2	45.4	41	45	80	64	3.86	2.50	5.3
Nov	29.26	.92	36.3	47.6	45.4	74	24	55.7	35.1	31	35	83	65	1.89	.97	4.3
Dec	29.27	1.14	29.9	39.3	37.0	70	12	46.4	27.7	23	25	76	59	.40	.31	4.5
Means	29.17	.82	47.6	57.5	54.3	102	−6	64.4	44.2	42	45	82	66	28.49	......	5.9

LEXINGTON, KY.

[Lat., 38° 2′ N.; long., 84° 33′ W.]

Months and year.	Pressure Mean.	Pressure Absolute range.	Temp. 8 a. m.	Temp. 8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean Maximum.	Mean Minimum.	Dew-point 8 a. m.	Dew-point 8 p. m.	Rel. hum. 8 a. m.	Rel. hum. 8 p. m.	Precip. Total.	Max. in 24 hours.	Mean cloudiness.
Jan	29.10	.84	41.0	45.6	44.0	71	14	50.1	37.8	36	38	84	76	5.34	1.28	7.8
Feb	28.96	.83	40.8	47.0	45.1	70	19	52.6	37.6	37	39	87	75	8.13	1.52	7.8
Mar	28.96	.97	34.2	41.4	38.6	70	6	45.8	31.4	27	29	77	66	9.91	2.15	7.9
Apr	28.99	.81	51.3	58.6	55.6	80	31	64.5	46.8	41	46	70	65	3.59	1.06	6.4
May	28.86	.60	59.6	65.9	63.2	86	39	71.5	55.0	51	52	75	64	4.71	1.96	6.2
June	28.94	.42	73.8	76.7	76.6	92	56	85.5	67.8	65	65	77	68	7.43	1.99	5.3
July	28.94	.46	72.6	77.3	75.8	94	56	81.6	66.9	64	62	74	62	3.14	2.34	4.3
Aug	28.98	.46	68.1	72.4	71.3	92	51	79.0	63.6	63	63	84	74	7.32	2.44	5.7
Sept	29.00	.33	62.9	67.5	66.8	86	45	74.7	58.8	58	59	85	76	1.82	.42	5.8
Oct	28.88	.73	51.6	56.2	56.3	82	31	63.8	48.8	47	46	84	71	2.38	.86	6.5
Nov	29.01	.54	43.1	49.7	48.6	73	26	56.4	40.7	36	36	76	64	3.54	.91	5.3
Dec	20.00	.76	33.1	37.4	36.8	58	14	43.8	29.8	27	27	79	68	4.05	1.83	6.2
Means	28.97	.65	52.7	58.0	56.6	94	6	64.4	48.8	46	47	79	69	61.36	......	6.3

LITTLE ROCK, ARK.

[Lat., 34° 45′ N.; long., 92° 6′ W.]

Months and year.	Pressure Mean.	Pressure Absolute range.	Temp. 8 a. m.	Temp. 8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean Maximum.	Mean Minimum.	Dew-point 8 a. m.	Dew-point 8 p. m.	Rel. hum. 8 a. m.	Rel. hum. 8 p. m.	Precip. Total.	Max. in 24 hours.	Mean cloudiness.
Jan	29.88	.88	46.6	52.4	50.0	75	21	57.4	42.6	42	43	85	71	8.48	2.73	6.6
Feb	29.73	1.01	45.5	54.3	51.0	78	20	58.8	43.3	41	43	85	68	6.48	1.40	5.3
Mar	29.75	.99	44.3	53.6	50.6	84	16	58.8	42.3	37	42	76	67	5.70	1.99	5.9
Apr	29.74	.57	56.9	65.6	62.3	84	38	70.6	54.0	50	53	80	68	7.77	3.08	6.3
May	29.61	.65	63.7	72.9	69.1	87	46	78.4	59.8	57	59	79	64	6.16	2.20	4.2
June	29.68	.35	73.2	79.8	78.2	94	60	87.2	69.1	69	69	86	70	8.28	3.41	4.7
July	29.70	.36	76.1	81.9	81.3	97	66	90.6	72.0	70	71	81	71	1.83	1.09	5.1
Aug	29.72	.35	71.9	50.2	78.0	94	61	86.7	69.3	68	69	87	69	2.59	.76	4.9
Sept	29.73	.33	65.2	70.9	70.6	92	51	77.7	63.6	63	65	92	82	5.55	1.87	6.7
Oct	29.71	.59	54.2	63.2	61.6	86	38	70.9	52.2	50	52	88	70	2.75	1.08	3.5
Nov	29.82	.48	47.6	57.4	55.1	77	33	64.4	45.8	43	44	85	63	5.21	1.54	4.7
Dec	29.85	.85	39.8	40.1	45.9	74	22	54.3	37.5	35	38	82	68	2.83	1.74	5.9
Means	29.74	.61	57.1	65.1	62.8	97	16	71.3	54.3	52	54	84	69	63.72	......	5.8

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

LEAVENWORTH, KANS.

[H=842. T=56. h=49.5.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	4.7	30	SW.	N.	13	3	0	9	8	5	2	11	11	10	6	15	10	10	25	0	0	0
Feb	4.9	27	NW.	N.	15	5	2	3	7	3	0	7	14	9	2	17	6	7	21	0	0	0
Mar	6.5	36	NW.	N.	13	9	4	6	5	2	0	10	13	7	8	16	8	5	16	0	0	0
Apr	9.1	36	SW.	S.	9	6	10	6	11	5	8	4	1	7	9	14	11	0	1	1	2	0
May	7.7	30	SW.	S.	16	4	4	1	19	9	2	7	0	5	12	14	18	0	0	0	5	0
June	7.8	30	NW.	S.	5	2	0	9	24	11	1	7	1	9	12	9	5	0	0	13	2	0
July	7.0	24	SW.	S.	5	5	7	8	17	11	1	5	3	9	11	11	6	0	0	20	4	0
Aug	5.3	28	S.	SE.	10	7	4	14	13	3	2	3	6	7	9	15	13	0	0	6	6	0
Sept	5.2	36	NW.	S.	13	5	3	3	20	2	2	4	8	4	10	16	9	0	0	0	8	0
Oct	6.1	24	S.	NW.	5	4	2	8	13	3	5	17	5	12	6	13	8	0	2	0	1	0
Nov	4.8	24	NW.	N.	10	4	1	3	6	8	9	9	10	16	5	9	6	0	11	0	1	0
Dec	6.0	29	SW.	NW.	7	8	2	6	11	6	3	12	7	16	4	11	2	2	20	0	1	0
Means	6.3	....	......	S.	121	62	39	76	154	68	35	96	79	111	94	160	102	25	96	40	25	0

LEXINGTON, KY.

[H=1,010.25. T=74.53. h=67.35.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan	17.0	56	NW.	SE.	1	8	0	14	12	11	3	13	0	0	14	17	20	2	12	0	0	0
Feb	15.1	60	SE.	NW.	0	12	1	13	2	13	1	14	0	3	7	18	17	1	18	0	2	0
Mar	16.0	62	NW.	NW.	2	9	1	9	2	14	6	19	0	4	6	21	16	5	14	0	3	0
Apr	15.6	48	SW.	SE.	2	15	1	18	2	14	1	7	0	9	8	13	14	0	1	0	0	0
May	11.3	48	SW.	SW.	1	7	1	11	1	26	1	13	1	7	16	8	13	0	0	0	5	0
June	10.2	60	N.	SW.	1	9	1	10	3	25	5	6	0	8	20	2	13	0	0	9	4	0
July	9.4	24	SW.	SW.	0	16	0	15	3	16	1	11	0	14	11	6	8	0	0	5	9	0
Aug	8.9	48	SW.	SW.	1	14	1	18	0	20	0	8	0	11	10	10	13	0	0	3	7	0
Sept	9.3	26	NE.	NE.	0	23	2	16	0	15	1	5	0	9	12	9	15	0	0	0	4	0
Oct	12.4	48	NW.	SW.	0	6	0	13	0	20	3	11	0	5	14	12	13	0	1	0	2	0
Nov	12.9	40	NW.	SW.	0	3	1	16	0	19	4	17	0	13	5	12	6	0	5	0	0	0
Dec	15.3	36	SW.	SW.	0	7	0	9	3	22	3	18	0	11	7	13	9	4	22	0	0	0
Means	12.8	....	......	SW.	8	129	8	161	28	224	29	142	1	94	130	141	157	12	63	17	36	0

LITTLE ROCK, ARK.

[H=309. T=74.7. h=53.9.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan	7.7	36	W.	S.	12	4	8	9	16	3	3	7	0	6	11	14	13	0	9	0	2	0
Feb	7.7	36	W	S.	11	11	5	1	15	6	0	6	1	11	6	11	13	1	3	0	1	0
Mar	8.6	42	SW.	N.	13	10	9	7	12	3	4	3	1	10	9	12	12	1	7	0	2	0
Apr	7.5	26	W.	SW.	3	10	11	3	9	12	6	6	0	11	4	15	14	0	0	0	3	0
May	5.6	28	SE.	S.	4	7	7	12	13	7	3	8	1	18	6	7	10	0	0	0	7	0
June	5.0	29	NW.	SW.	1	3	0	8	5	34	4	5	0	11	13	6	13	0	0	12	4	0
July	4.4	36	SE.	NW.	2	12	1	13	0	13	3	14	4	12	10	9	11	0	0	18	2	0
Aug	4.6	24	SW.	NE.	2	15	7	14	3	10	0	9	2	11	13	7	9	0	0	6	2	0
Sept	5.2	24	NE.	NE.	3	20	2	17	0	3	0	14	1	7	6	17	14	0	0	2	2	0
Oct	5.1	24	NW.	SW.	3	3	1	10	3	15	5	14	8	17	8	6	9	0	0	0	0	0
Nov	5.6	23	S.	NW.	7	7	1	1	9	12	5	14	4	14	7	9	7	0	0	0	1	0
Dec	6.2	29	S.	N.	11	5	4	4	8	8	5	11	6	11	4	16	7	0	8	0	1	0
Means	6.1	....	......	SW.	72	107	56	99	93	126	38	111	28	139	97	129	132	3	27	38	27	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

LOS ANGELES, CAL.

[Lat., 34° 3′ N.; long., 118° 15′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.77	.54	43.0	50.9	49.1	67	34	57.7	40.5	34	40	78	68	7.83	4.17	4.5
Feb	29.71	.44	46.5	58.3	54.2	81	35	61.9	43.5	36	43	71	60	1.36	.70	3.0
Mar	29.71	.59	48.8	60,9	57.5	81	40	68.5	46.5	38	44	70	58	.66	,30	3.8
Apr	29.67	.30	50.8	61.0	59.4	94	42	69.7	49.2	46	49	86	67	.22	.21	5.0
May	29.63	.37	55.8	65.1	63.2	96	43	72.3	51.1	50	51	84	62	.03	.02	5.8
June	29.60	.25	58.5	71.6	67.6	105	48	79.1	56.1	50	52	78	54	.02	.02	2.8
July	29.57	.30	61.7	76.5	73.2	97	55	85.5	60.8	57	58	84	54	.00	.00	2.1
Aug	29.58	.26	63.1	73.5	72.8	98	56	83.7	62.0	58	59	83	62	.03	.03	3.4
Sept	29.57	.30	61.8	71.6	71.4	94	54	82.3	60.4	55	58	80	64	.06	.04	4.1
Oct	29.59	.40	57.7	68.7	67.8	99	46	82.4	53.2	42	53	62	60	.03	.03	1.7
Nov	29.69	.41	56.7	67.8	66.2	96	41	81.2	51.2	29	41	39	41	.13	.13	1.3
Dec	29.72	.47	54.8	62.3	61.2	82	43	70.9	51.6	37	45	57	56	2.32	1.20	4.4
Means	29.65	.39	54.9	65.7	63.6	105	34	74.8	52.4	44	49	72	59	12.69	......	3.6

LOUISVILLE, KY.

[Lat., 38° 15′ N.; long., 85° 45′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
Jan	29.64	1.01	42.1	47.1	44.8	72	14	52.3	37.2	35	38	77	72	5.73	2.05	7.1
Feb	29.50	.95	41.6	48.1	46.5	73	22	54.6	38.4	34	38	76	69	6.25	1.70	6.4
Mar	29.51	1.18	36.6	44.4	41.2	67	13	48.4	34.1	29	30	75	60	9.58	2.51	6.2
Apr	29.52	.84	52.5	61.3	58.0	82	34	67.1	49.0	40	45	65	58	3.51	.89	5.7
May	29.38	.66	59.8	67.8	64.8	88	39	74.5	55.0	49	51	68	58	3.15	.91	4.8
June	29.44	.49	74.3	80.7	78.8	98	60	88.0	69.6	63	67	68	64	6.96	1.65	4.8
July	29.45	.44	72.9	82.4	78.4	96	59	88.6	68.1	59	61	64	50	2.05	1.73	3.4
Aug	29.49	.50	69.1	75.6	71.7	96	55	83.4	66.0	60	61	74	63	4.18	.96	5.1
Sept	29.51	.38	63.0	69.2	68.0	91	46	76.1	59.8	56	58	79	69	2.71	1.06	6.2
Oct	29.41	.70	53.0	58.1	57.9	85	35	65.8	50.0	46	46	77	67	3.69	.70	6.3
Nov	29.54	.58	45.1	52.4	51.0	73	27	59.4	42.5	36	38	70	60	4.54	1.40	5.1
Dec	29.54	.76	33,4	39.7	38.8	59	17	46.0	31.5	24	26	70	62	3.06	1.12	5.0
Means	29.49	.71	53.6	60.6	58.6	98	13	67.0	50.1	44	47	72	63	55.41	......	5.5

LYNCHBURG, VA.

[Lat., 37° 25′ N.; Long., 79° 9′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
Jan	29.52	.82	42.2	47.3	47.2	77	23	56.6	37.9	32	34	71	62	1.59	.56	5.5
Feb	29.38	.83	41.8	48.1	47.2	74	25	56.1	38.4	36	37	80	68	4.22	.84	5.7
Mar	29.34	1.11	40.4	44.7	44.6	75	20	53.4	35.7	30	30	70	58	3.16	.82	5.5
Apr	29.40	1.15	52.1	59.4	57.2	85	28	69.1	45.2	40	40	65	51	1.98	.57	5.0
May	29.26	.61	62.6	66.7	66.3	88	38	77.1	55.5	52	55	70	68	4.71	.82	6.3
June	29.31	.60	73.8	77.1	76.6	95	52	87.0	66.1	63	64	70	65	1.63	.74	5.8
July	29.34	.53	72.1	76.4	75.6	97	54	84.5	66.7	63	65	74	69	4.83	.88	5.5
Aug	29.35	.44	70.3	73.2	74.0	93	47	83.8	64.1	62	63	75	70	3.81	1.28	5.3
Sept	29.41	.41	65.3	68.9	70.0	90	47	78.6	61.3	59	61	80	77	1.94	.85	6.2
Oct	29.24	.96	53.9	56.8	57.5	81	34	65.1	49.9	45	47	74	72	5.18	2.39	5.4
Nov	29.38	.60	44.7	51.8	51.4	81	26	61.7	41.2	36	38	73	62	.03	.02	5.1
Dec	29.36	1.28	33.4	38.3	38.2	62	19	46.2	30.3	22	26	67	64	5.14	3.13	5.4
Means	29.36	.78	54.4	59.1	58.8	97	19	68.3	49.4	45	47	72	66	38.22	......	5.5

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

LOS ANGELES, CAL.

[H=330. T=74.211. h=65.626.]

Months and year.	Wind.													Number of days—									
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	4.0	17	E.	NE.	11	14	10	0	2	5	14	6	0	10	13	8	9	0	0	0	0	0
Feb	3.5	18	W.	N.	12	7	4	6	0	7	11	8	1	15	9	4	4	0	0	0	0	0
Mar	4.2	24	NW.	W.	5	14	7	0	3	2	19	10	2	13	13	5	5	9	0	0	0	0
Apr	3.4	19	NW.	W.	4	11	10	0	1	3	25	4	2	6	20	4	2	0	0	1	0	0
May	3.6	15	W.	W.	4	7	10	5	4	6	25	1	0	5	18	8	2	0	0	1	0	0
June	3.8	18	W.	W.	9	9	4	3	5	9	18	3	0	9	21	0	1	0	0	5	0	0
July	3.4	13	W.	W.	1	6	6	2	3	10	21	3	10	20	11	0	0	0	0	5	0	0
Aug	3.5	14	W.	W.	3	6	5	2	3	4	31	2	6	10	20	1	1	0	0	5	0	0
Sept	3.2	15	S.	W.	4	5	7	1	3	1	28	5	6	12	12	6	3	0	0	5	0	0
Oct	3.1	15	W.	W.	10	10	1	1	3	2	21	8	6	25	2	4	2	0	0	6	0	0
Nov	3.7	14	W.	W.	15	8	5	0	1	0	17	14	0	25	4	1	2	0	0	4	0	0
Dec	3.7	18	W.	N.	17	8	6	0	3	3	11	13	1	13	12	6	7	0	0	0	0	0
Means	3.6	----	------	W.	95	105	75	20	31	52	241	77	34	163	155	47	38	0	0	32	0	0

LOUISVILLE, KY.

[H=551. T=100.2. h=103.4.]

Jan	8.6	36	SW.	S.	7	4	4	6	17	12	8	4	0	5	9	17	16	1	10	0	0	0
Feb	7.4	33	SW.	SW.	6	9	8	3	7	9	5	6	3	6	6	16	16	0	8	0	3	0
Mar	8.4	42	W.	SW.	7	7	3	5	7	14	7	9	3	8	9	14	15	5	12	0	2	0
Apr	9.8	37	W.	NE	0	20	3	8	9	9	10	1	0	8	9	13	13	0	0	0	0	0
May	7.3	30	SW.	SW.	1	6	2	9	15	16	6	7	0	11	9	11	11	0	0	0	1	0
June	6.8	39	NW.	SW.	3	11	0	6	11	21	7	1	0	12	13	5	18	0	0	0	6	0
July	6.4	32	W.	SW.	2	13	4	5	10	14	9	4	1	19	9	3	4	0	0	10	1	0
Aug	6.0	34	SW.	SW.	11	8	9	6	7	12	4	4	1	11	10	10	12	0	0	12	3	0
Sept	6.4	24	NE.	NE.	7	22	2	11	6	5	3	3	1	8	7	15	11	0	0	4	0	0
Oct	7.8	37	W.	SW.	1	6	1	11	5	19	9	9	1	6	11	14	12	0	0	1	1	0
Nov	7.4	30	W.	SW.	5	11	1	4	10	16	5	3	5	13	6	11	8	0	4	0	0	0
Dec	9.2	31	W.	SW.	2	14	0	6	6	15	8	8	3	12	10	9	9	0	16	0	0	0
Means	7.6	----	------	SW.	52	131	37	80	110	162	81	59	18	119	108	138	140	6	50	27	17	0

LYNCHBURG, VA.

[H=685. T=82.4. h=75.6.]

Jan	5.1	32	NW.	S.	12	2	8	0	17	6	4	11	2	8	14	9	11	1	9	0	0	0
Feb	5.1	25	NW.	SW.	11	8	3	2	11	12	1	7	1	8	9	11	13	0	9	0	2	0
Mar	6.8	26	NW.	S.	12	3	2	3	18	2	4	15	3	9	12	10	11	0	13	0	0	0
Apr	5.0	28	NW.	S.	7	5	8	2	14	4	3	13	4	12	9	9	13	0	1	0	1	0
May	4.2	45	NW.	S.	7	4	9	7	15	1	5	10	4	9	16	6	17	0	0	0	7	0
June	3.8	22	W.	NW.	4	2	11	3	10	3	7	19	1	3	21	6	15	0	0	9	9	0
July	3.5	28	N.	S.	12	3	10	10	14	3	8	1	1	10	13	8	14	0	0	9	8	0
Aug	3.8	27	NW.	S.	6	1	2	10	11	10	11	11	0	7	16	8	13	0	0	1	5	0
Sept	4.1	24	N.	E.	10	4	12	7	10	3	5	7	2	4	16	10	13	0	0	0	4	0
Oct	4.6	24	NW.	NW.	3	6	4	3	5	4	14	19	4	9	12	10	13	0	0	0	0	0
Nov	4.1	24	NW.	NW.	6	4	10	4	7	8	4	13	4	13	7	10	3	0	6	0	0	0
Dec	5.6	45	NW.	NW.	10	11	2	4	1	6	12	12	4	9	14	8	11	1	20	0	0	0
Means	4.6	----	------	NW.	100	53	81	55	133	62	78	138	30	101	159	105	147	2	58	19	36	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

MANCHESTER, N. H.

[Lat., 42° 58′ N.; long., 71° 28′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a. m.	Dew-point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.89	1.51	23.1	27.9	26.0	62	— 1	35.0	17.0	18	20	81	73	3.02	.74	6.2
Feb	29.82	1.42	25.2	28.4	28.2	57	— 6	36.6	19.8	20	21	80	76	3.96	1.18	6.2
Mar	29.71	1.10	27.5	31.7	30.8	64	— 4	38.4	23.1	20	23	77	72	5.73	1.49	5.8
Apr	29.81	1.05	43.0	44.6	44.4	74	24	55.6	33.1	24	29	51	58	1.76	.76	4.1
May	29.70	.73	55.4	55.8	57.0	80	35	67.7	46.2	44	46	68	72	4.54	1.30	5.8
June	29.71	.57	62.0	63.2	63.1	87	42	73.6	52.6	50	51	69	68	3.66	1.14	4.9
July	29.76	.61	67.7	68.8	68.6	93	42	79.6	57.5	56	58	69	69	2.91	1.44	4.6
Aug	29.74	.80	64.8	65.7	66.6	87	46	76.4	56.9	56	57	75	75	4.57	1.36	4.9
Sept	29.87	.69	58.8	59.5	60.9	81	33	69.7	52.1	52	54	80	82	4.71	1.31	5.4
Oct	29.64	1.04	46.0	46.5	47.8	78	28	55.8	39.9	38	40	76	80	6.19	2.08	6.2
Nov	29.74	.91	35.1	35.8	36.6	63	11	45.0	28.3	26	26	71	70	1.35	1.03	4.9
Dec	89.75	1.24	16.5	19.7	19.2	44	— 5	28.3	10.1	9	12	75	74	3.30	1.13	5.0
Means	29.76	.97	43.8	45.6	45.8	93	— 6	55.1	36.4	34	36	73	72	45.70	......	5.3

MANISTEE, MICH.

[Lat., 44° 13′ N.; long., 86° 16′ W.]

Jan	29.41	1.25	26.7	28.8	27.3	44	2	31.3	23.3	23	24	88	83	5.64	2.02	8.1
Feb	29.34	1.09	26.1	28.8	28.0	52	10	32.5	23.5	21	24	81	81	2.55	.80	6.9
Mar	29.37	1.10	22.7	27.5	25.4	46	— 7	31.2	19.6	17	22	78	78	2.64	.54	5.2
Apr	29.43	1.10	39.7	43.0	41.8	72	20	49.3	34.2	31	32	74	66	3.93	1.80	3.6
May	29.23	.81	46.2	49.4	47.9	78	30	54.1	41.7	38	39	75	70	3.17	.58	4.6
June	29.29	.68	64.7	67.0	65.6	84	44	73.6	57.7	58	58	80	75	3.03	1.02	3.0
July	29.33	.59	65.0	68.6	67.0	89	48	73.9	60.0	57	56	76	67	2.34	1.08	3.0
Aug	29.38	.60	60.7	64.7	62.6	91	40	69.7	55.6	53	54	77	70	2.69	.74	3.7
Sept	29.44	.81	53.0	59.0	57.0	84	34	65.1	48.9	46	49	79	70	1.12	.40	2.8
Oct	29.26	.83	45.2	49.1	48.2	67	31	53.6	42.7	40	41	84	75	5.59	1.37	6.0
Nov	29.34	.79	36.6	39.4	38.3	53	26	43.0	33.6	31	32	81	74	2.53	1.00	4.8
Dec	29 37	1.01	26.6	29.8	27.8	45	8	33.2	22.3	21	23	79	76	1.02	.38	5.8
Means	29.35	.89	42.8	46.3	44.7	91	— 7	50.9	38.6	36	38	79	74	36.25	......	4.8

MARQUETTE, MICH.

[Lat., 46° 34′ N.; long., 87° 24′ W.]

Jan	29.26	1.26	17.6	19.4	18.8	46	— 6	25.7	11.8	11	13	76	76	3.11	1.35	7.5
Feb	29.17	1.25	18.9	22.3	20.3	45	0	27.0	13.6	13	15	78	75	5.17	1.35	8.4
Mar	29.20	1.10	17.6	22.7	20.8	40	—12	27.1	14.4	12	15	77	74	2.20	.78	6.3
Apr	29.29	1.03	37.7	40.0	39.2	69	14	47.4	30.9	31	33	78	76	1.67	.80	5.5
May	29.11	.91	41.2	42.8	42.2	78	24	49.3	35.2	35	36	78	77	2.96	.50	6.6
June	29.15	.76	61.9	62.7	61.8	89	40	70.8	52.8	53	52	75	72	3.66	1.30	5.6
July	29.16	.66	64.3	65.8	65.2	91	46	73.9	56.4	54	55	72	69	4.07	2.32	5.4
Aug	29.22	.66	59.0	61.2	60.2	84	39	66.9	53.5	51	52	75	74	2.17	.43	5.9
Sept	29.27	.88	52.0	55.4	55.0	81	34	63.2	46.7	43	46	74	72	1.52	.32	4.7
Oct	29.12	.90	43.3	46.3	45.4	70	28	51.1	39.8	37	39	79	77	3.18	.74	7.4
Nov	29.17	.84	31.8	34.8	34.0	50	19	39.5	28.6	26	27	79	74	1.94	.72	7.3
Dec	29.19	1.16	21.5	25.0	23.1	48	3	29.2	17.0	15	18	77	75	2.82	.68	7.5
Means	29.19	.97	38.9	41.5	40.5	91	—12	47.6	33.4	32	33	76	74	34.47	......	6.5

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

MANCHESTER, N. H.

[H=247. T=75.83. h=68.27.]

	Wind.													Number of days—								
Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	6.6	35	NW.	NW.	11	2	3	3	2	10	6	25	0	7	14	10	15	11	30	0	0	0
Feb	6.9	36	W.	NW.	4	5	5	5	2	6	6	21	2	8	6	14	15	9	24	0	0	0
Mar	6.6	24	NW.	NW.	7	4	1	5	5	6	4	29	1	10	8	13	18	6	22	0	0	0
Apr	6.9	30	NW.	NW.	3	5	4	5	5	8	3	26	1	17	8	5	10	0	15	0	0	0
May	5.9	23	S.	NW.	4	4	7	8	10	9	4	16	0	7	14	10	15	0	0	0	4	0
June	5.1	24	NW.	NW.	4	5	4	7	5	12	0	22	1	12	12	6	10	0	0	0	4	0
July	4.7	20	NW.	NW.	7	1	2	11	12	9	1	15	4	14	10	7	8	0	0	4	2	0
Aug	4.8	24	NW.	NW.	4	4	1	9	4	12	4	22	2	10	14	7	13	0	0	0	1	0
Sept	4.1	21	NW.	NW.	6	6	4	6	11	5	3	17	2	11	8	11	15	0	0	0	0	0
Oct	4.9	24	NW.	NW.	7	5	2	4	4	4	2	20	8	10	7	14	15	0	3	0	1	1
Nov	5.5	26	NW.	NW.	5	1	0	3	9	11	6	25	0	13	7	10	9	2	21	0	0	0
Dec	6.9	36	NW.	NW.	11	4	0	1	5	12	1	28	0	12	9	10	12	19	31	0	0	0
Means	5.7	....	......	NW.	73	46	33	67	74	104	40	272	21	131	117	117	155	47	146	4	12	1

MANISTEE, MICH.

[H=615. T=43. h=28.]

Jan	10.0	42	W.	W.	3	3	8	10	12	8	14	4	0	5	3	23	17	15	24	0	0	0
Feb	10.2	30	W.	E.	8	3	11	8	7	7	6	6	0	6	5	17	15	14	24	0	0	0
Mar	9.6	42	W.	E.	6	4	13	5	7	9	7	11	0	8	14	9	20	13	27	0	0	0
Apr	8.4	24	S.	N.	15	7	9	5	15	2	1	6	0	18	5	7	13	0	8	0	0	0
May	8.0	30	SW.	S.	7	3	7	3	15	11	5	10	1	13	11	7	16	0	1	0	0	0
June	6.2	26	S.	S.	1	2	6	5	18	11	10	5	2	21	6	3	14	0	0	0	2	0
July	7.2	30	SW.	S.	9	1	4	3	20	14	2	7	2	20	7	4	7	0	0	0	1	0
Aug	6.8	42	W.	S.	10	2	8	10	13	5	7	5	2	15	11	5	12	0	0	1	0	0
Sept	7.4	30	SW.	S.	8	2	9	6	16	7	5	3	4	21	6	3	8	0	0	0	0	0
Oct	7.2	30	SW.	N.	14	2	14	2	3	7	6	6	8	6	13	12	18	0	1	0	0	0
Nov	8.7	36	SW.	N.	12	2	5	4	9	10	10	5	3	12	8	10	15	1	12	0	0	0
Dec	9.0	48	W.	E.	4	4	12	7	7	9	11	6	2	8	12	11	13	14	26	0	0	0
Means	8.2	....	......	S.	97	35	106	68	142	100	84	74	24	153	101	111	168	57	123	1	3	0

MARQUETTE, MICH.

[H=735. T=67.85. h=55.71.]

Jan	10.3	54	SW.	NW.	0	2	2	6	6	9	17	18	2	2	12	17	18	25	31	0	0	0
Feb	12.6	42	SW.	NW.	4	4	1	7	8	8	8	16	0	0	10	18	19	18	28	0	0	1
Mar	9.9	30	NW.	NW.	7	3	8	6	5	2	8	26	2	5	13	13	18	19	31	0	0	0
Apr	10.7	36	SW.	NW.	5	7	2	6	7	7	4	19	3	8	14	8	14	0	20	0	0	0
May	9.0	37	SE.	NW.	10	5	6	7	6	9	4	13	2	2	18	11	18	1	10	0	1	0
June	6.8	30	SW.	NW.	5	4	4	12	5	6	8	13	3	11	11	8	11	0	0	0	3	0
July	8.6	37	SW.	NW.	2	5	3	6	10	9	6	20	1	9	13	9	10	0	0	1	3	0
Aug	9.6	48	SW.	NW.	3	2	3	5	13	9	8	17	2	7	15	9	13	0	0	0	3	0
Sept	9.8	38	SW.	W.	10	1	1	4	11	8	13	10	2	11	12	7	12	0	0	0	4	0
Oct	7.1	35	SE.	NW.	11	1	2	4	8	4	5	23	4	5	9	17	18	0	4	0	0	1
Nov	9.7	44	SW.	NW.	6	2	4	1	6	4	6	23	8	1	13	16	14	6	22	0	0	0
Dec	8.7	43	W.	NW.	2	1	0	3	14	4	12	23	3	2	14	15	20	15	31	0	0	0
Means	9.4	....	......	NW.	65	37	31	67	99	79	99	221	32	63	154	148	185	84	177	1	14	2

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

MEMPHIS, TENN.

[Lat., 35° 9′ N.; long., 90° 3′ W.]

Months and year.	Pressure (actual).		Temperature.					Mean.		Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Maximum.	Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	*In.*	*In.*	°	°	°	°	°	°	°	°	°	%	%	*In.*	*In.*	
Jan	29.89	.86	46.9	52.3	50.8	79	23	57.8	43.8	43	44	86	76	8.43	2.78	6.2
Feb	29.74	.99	46.0	56.6	51.4	79	26	58.6	44.2	41	42	85	68	8.13	2.41	5.3
Mar	29.75	1.04	43.8	52.1	49.2	81	17	56.8	41.5	36	36	75	59	7.93	2.42	5.6
Apr	29.75	.60	57.4	65.3	61.8	83	39	70.3	53.4	49	51	76	62	5.10	1.15	6.2
May	29.62	.59	64.3	71.1	69.4	89	48	78.6	60.2	59	58	78	65	4.42	.86	4.3
June	29.68	.30	76.2	81.7	80.6	96	63	89.7	71.6	70	70	81	68	3.55	1.71	4.2
July	29.68	.37	76.4	82.7	81.0	98	64	90.3	71.6	69	70	79	67	2.82	1.30	3.6
Aug	29.72	.35	72.1	78.4	77.2	94	58	86.1	68.3	67	69	85	74	7.56	2.63	5.0
Sept	29.72	.27	65.5	70.7	70.8	90	50	78.2	63.3	63	65	91	83	9.07	4.50	6.6
Oct	29.69	.59	55.5	62.6	61.8	86	34	70.0	53.6	53	57	91	84	2.75	1.66	3.7
Nov	29.82	.59	48.8	57.9	56.2	77	36	64.7	47.6	45	52	89	83	4.88	1.85	3.8
Dec	29.84	.80	41.0	47.5	46.0	73	23	53.2	38.7	38	39	89	75	3.64	1.24	5.6
Means	29.74	.61	57.8	64.7	63.0	98	17	71.2	54.8	53	54	84	72	68.28	......	5.0

MERIDIAN, MISS.

[Lat., 32° 21′ N.; long., 88° 41′ W.]

Jan	29.80	.59	52.9	58.2	57.8	79	26	65.7	49.8	49	50	86	76	2.73	1.08	5.9
Feb	29.72	.76	52.1	59.0	58.0	80	29	67.4	48.5	49	49	89	72	7.78	2.94	5.6
Mar	29.74	.78	48.0	56.8	54.0	82	19	63.5	44.5	41	43	79	62	4.32	2.21	4.9
Apr	29.75	.43	60.1	67.7	65.1	85	40	74.6	55.6	54	54	82	65	4.43	1.21	5.8
May	29.61	.54	65.5	72.8	70.0	89	41	80.8	59.1	59	60	81	65	7.42	1.92	4.8
June	29.69	.30	75.3	80.7	79.4	96	63	89.7	69.1	69	69	81	68	3.13	1.70	5.4
July	29.66	.43	75.3	79.4	80.0	97	61	89.8	70.2	70	70	83	74	3.37	1.29	6.0
Aug	29.70	.28	72.4	78.1	77.3	92	58	87.1	67.5	68	69	86	74	4.94	1.28	4.6
Sept	29.67	.26	67.7	71.7	73.2	90	50	81.9	64.5	66	68	93	87	7.54	1.90	6.3
Oct	29.67	.59	55.2	62.3	62.7	87	33	72.9	52.5	52	56	88	81	3.48	1.61	3.4
Nov	29.79	.43	46.9	58.8	57.8	79	28	70.5	45.0	44	49	90	70	.40	.26	3.1
Dec	29.83	.70	41.7	50.9	49.6	72	25	60.0	39.1	36	39	80	67	2.21	1.67	5.0
Means	29.73	.51	59.4	66.4	65.4	97	19	75.3	55.4	55	56	85	72	51.75	......	5.0

MILWAUKEE, WIS.

[Lat., 43° 2′ N.; long., 87° 54′ W.]

Jan	29.36	1.31	2.30	27.7	26.0	47	—10	32.9	19.2	19	23	84	82	2.51	1.16	6.2
Feb	29.28	.98	2.02	29.9	29.0	59	— 2	35.2	22.9	23	25	88	82	1.94	.72	6.8
Mar	29.30	1.11	22.2	28.6	26.6	50	— 7	33.0	20.2	17	21	81	72	2.68	.98	5.3
Apr	29.34	1.06	41.9	44.9	44.3	72	27	51.9	36.7	33	34	73	66	2.84	1.05	5.0
May	29.15	.86	48.1	51.1	50.0	84	32	58.2	41.9	40	40	76	68	4.95	1.96	6.3
June	29.21	.69	65.8	69.3	67.9	95	48	75.6	60.2	59	59	79	72	4.09	1.07	5.5
July	29.25	.56	68.1	73.0	71.2	94	52	79.0	63.4	58	59	70	63	1.77	1.07	3.5
Aug	29.31	.58	62.5	68.2	65.7	96	48	73.3	58.1	55	56	76	66	3.18	.92	5.1
Sept	29.36	.74	54.7	60.2	49.2	88	38	67.4	50.9	47	50	77	72	.65	.30	4.4
Oct	29.19	.76	46.2	50.1	49.4	71	28	55.3	43.6	42	43	86	78	2.96	.71	6.5
Nov	29.28	.74	35.7	40.9	39.8	57	25	46.3	33.4	29	31	77	71	2.02	1.07	5.8
Dec	29.31	.87	25.9	29.4	28.1	51	7	33.8	22.4	19	21	76	71	.50	.23	5.5
Means	29.28	.86	43.4	47.8	46.4	96	—10	53.5	39.4	37	38	79	72	30.09	......	5.5

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

MEMPHIS, TENN.

[H=329. T=108. h=100.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	9.1	36	W.	S.	7	10	4	13	15	2	4	6	1	7	10	14	16	0	8	0	2	0
Feb	8.3	42	S.	N.	14	6	8	3	11	5	1	8	0	9	9	10	13	1	3	0	1	0
Mar	9.6	48	SW.	S.	14	8	8	8	15	2	0	7	0	7	14	10	13	1	10	0	4	0
Apr	8.9	38	S.	S.	9	5	3	6	20	7	7	3	0	8	10	12	11	0	0	0	0	0
May	6.6	42	NW	S.	5	5	8	12	15	4	5	8	0	12	16	3	12	0	0	0	3	0
June	5.9	50	SW.	SW.	0	5	3	8	22	18	2	2	0	15	12	3	9	0	0	18	3	0
July	5.4	40	NW	SW.	3	12	5	6	9	9	10	8	0	16	11	4	10	0	0	16	4	0
Aug	5.4	30	SW.	SW.	12	7	3	12	10	8	4	6	0	12	11	8	12	0	0	8	7	0
Sept	5.6	34	NW	NW.	6	7	10	10	7	3	2	15	0	6	9	15	18	0	0	0	1	0
Oct	6.3	30	W.	W.	3	2	3	4	18	9	21	6	1	18	7	6	10	0	0	0	0	0
Nov	5.5	24	W.	N.	21	0	1	4	13	4	5	11	1	17	6	7	7	0	0	0	0	0
Dec	7.3	35	W.	NW.	14	3	8	4	12	3	5	18	0	8	12	11	7	0	7	0	1	0
Means	7.0	....	.....	S.	108	70	59	90	162	74	66	98	3	135	127	103	138	2	28	42	26	0

MERIDIAN, MISS.

[H=358. T=53. h=42.]

Jan	6.5	26	NW	S.	10	4	7	8	13	1	0	5	14	7	14	10	11	0	3	0	0	0
Feb	6.8	36	S.	S.	6	1	3	2	22	2	0	5	15	10	6	12	10	0	2	0	5	0
Mar	8.4	30	S.	N.	15	5	2	4	15	2	1	9	9	9	15	7	9	0	6	0	2	0
Apr	6.0	23	NW	S.	8	1	7	3	20	1	1	4	15	11	8	11	10	0	0	0	1	0
May	4.6	38	W.	S.	8	9	9	3	11	4	1	3	14	11	14	6	13	0	0	0	9	0
June	4.3	26	S.	S.	5	5	4	3	18	12	5	3	5	6	20	4	11	0	0	15	7	0
July	3.8	38	N.	S.	9	4	4	3	13	11	2	6	10	6	16	9	13	0	0	16	11	0
Aug	3.9	36	S.	E.	11	2	12	3	8	6	2	6	12	12	14	5	12	0	0	6	7	0
Sept	3.4	24	W.	NE.	10	12	5	3	1	2	2	5	20	4	14	12	22	0	0	0	7	0
Oct	4.2	26	NW	N.	10	6	0	0	5	6	2	5	28	19	9	3	5	0	0	0	0	0
Nov	3.9	24	S.	N.	8	0	5	1	7	2	1	2	34	20	6	4	4	0	3	0	0	0
Dec	5.9	30	W.	NW.	8	1	2	0	12	4	0	13	22	11	12	8	3	0	9	0	1	0
Means	5.1	....	.....	S.	108	50	60	33	145	53	17	66	198	126	148	91	123	0	23	37	50	0

MILWAUKEE, WIS.

[H=699. T=106. h=100.]

Jan	11.3	42	W.	W.	4	0	2	5	8	14	14	13	2	8	9	14	13	12	26	0	0	0
Feb	12.2	44	NW.	NW.	8	3	0	7	5	10	9	12	2	6	7	15	13	8	22	0	0	0
Mar	12.9	50	NE.	NW.	9	2	5	6	6	6	8	20	0	11	9	11	15	10	26	0	0	0
Apr	11.7	40	N.	N.	20	0	6	7	12	4	0	2	0	11	11	8	11	0	8	0	4	0
May	11.8	42	SW.	N.	15	5	3	8	5	9	12	5	0	6	12	13	16	0	0	0	3	0
June	8.2	42	S.	N.	11	5	9	4	9	11	4	6	1	8	11	11	12	0	0	1	10	0
July	10.1	40	NE.	NE.	4	12	5	6	8	11	8	6	2	16	11	4	8	0	0	3	6	0
Aug	8.8	32	NW	SW.	8	2	10	6	3	11	10	11	1	11	13	7	9	0	0	1	4	0
Sept	9.7	44	W.	SW.	9	5	7	6	6	11	6	9	1	13	12	5	7	0	0	0	0	0
Oct	10.2	41	N.	NW.	12	2	5	11	2	7	7	15	1	6	11	14	16	0	2	0	1	0
Nov	11.5	37	W.	W.	3	2	7	0	2	11	20	15	0	8	9	13	10	0	12	0	0	0
Dec	12.8	44	W.	W.	2	3	2	3	4	14	18	15	1	12	6	13	9	14	26	0	0	0
Means	10.9	....	.....	NW.	105	50	61	69	70	119	116	129	11	116	121	128	139	44	117	5	28	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

MOBILE, ALA.

[Lat., 30° 41′ N.; long., 88° 2′ W.]

Months and year.	Pressure (actual).		Temperature.					Mean.		Dew point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absalute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Maximum.	Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	80.24	.41	57.9	62.2	62.0	77	33	69.1	54.8	55	58	91	86	.60	.40	6.1
Feb	30.09	.61	55.9	62.0	61.4	76	36	69.2	53.6	54	57	92	85	2.95	1.13	5.8
Mar	30.10	.68	52.5	58.8	57.1	78	25	65.2	49.0	48	51	86	77	2.18	.68	5.4
Apr	30.11	.43	64.2	69.1	68.0	84	48	76.2	59.8	60	60	86	75	1.98	1.26	5.7
May....	29.96	.52	69.4	74.1	72.7	87	54	81.1	64.3	64	65	84	74	5.50	2.06	5.8
June ...	30.04	.31	77.4	79.0	80.0	97	67	87.9	72.0	73	71	86	78	4.23	1.14	6.5
July ...	30.00	.42	77.2	79.6	80.5	96	69	88.0	73.0	73	72	87	79	9.22	2.67	6.6
Aug	30.04	.24	76.0	79.3	79.6	91	65	87.8	71.4	72	73	87	82	4.79	1 22	5.7
Sept ...	30.00	.22	72.2	75.7	76.6	90	54	84.2	69.0	70	71	91	86	3.61	1.12	6.2
Oct	30.01	.60	61.1	67.3	66.7	86	41	75.2	58.2	58	61	90	82	5.58	3.04	4.5
Nov	30.12	.34	52.6	62.4	61.1	81	36	71.2	51.0	50	56	92	81	.32	.21	3.6
Dec	30.14	.66	46.2	54.5	54.1	76	31	63.7	44.5	43	50	90	84	1.55	1.37	5.4
Means .	30.07	.45	63.6	68.7	68.3	97	25	76.6	60.0	60	02	88	81	42.51	......	5.6

MONTGOMERY, ALA.

[Lat., 32° 23′ N.; long., 86° 18′ W.]

Jan.....	30.06	.45	51.6	59.4	57.4	78	29	65.8	48.9	47	49	84	71	2.53	1.76	6.4
Feb	29.89	.65	52.8	62.1	59.8	81	30	69.4	50.2	48	49	85	65	3.43	1.38	6.0
Mar	29.90	.64	48.5	58.2	55.6	84	21	65.2	46.0	42	45	79	63	3.93	2.01	5.5
Apr	29.91	.55	60.2	70.3	66.6	86	44	76.5	56.8	54	57	80	64	1.37	.40	5.3
May....	29.76	.59	66.2	73.8	72.2	89	45	82.6	61.9	59	58	78	61	10.19	3.54	5.5
June ...	29.83	.38	75.8	81.0	81.1	98	66	91.3	70.9	68	68	78	66	4.57	1.32	5.5
July....	29.81	.49	76.4	81.8	81.6	97	69	90.7	72.4	70	69	80	67	3.42	1.38	6.4
Aug	29.85	.29	73.6	80.8	79.4	92	61	89.1	69.8	67	66	80	64	4.73	2 69	5.8
Sept ...	29.81	.25	70.2	74.8	75.8	91	57	81.2	67.5	67	67	88	79	6.03	2.23	6.8
Oct	29.81	.51	57.7	65.9	64.9	88	37	74.3	55.5	53	55	85	70	5.87	2.24	3 7
Nov	29.93	.42	49.6	63.2	60.1	82	33	72.4	47.8	44	48	82	58	.26	.25	2.3
Dec	29.96	.50	43.5	54.3	51.6	73	29	61.5	41.6	37	39	78	59	1.85	.94	4.3
Means .	29.98	.48	60.5	68.8	67.2	98	21	76.9	57.4	55	56	81	66	48.18	......	5.3

MONTROSE, COLO.

[Lat., 38° 30′ N.; long., 107° 56′ W.]

Jan.....	24.24	.78	22.8	27.6	26.6	58	— 3	38.1	15.0	10	12	50	53	.80	.25	4.6
Feb	24.21	.94	28.5	38.1	34.2	62	—13	45.9	22.5	9	14	48	40	.78	.35	4.1
Mar	24.26	.78	31.0	45.5	39.8	64	— 2	51.3	28.2	15	24	54	47	.50	.41	5.4
Apr	24.27	.58	40.1	56.6	49.4	74	23	61.3	37.5	21	26	49	36	1.36	.88	4.7
May....	24.23	.47	50.3	71.0	59.6	83	31	74.1	45.1	24	20	37	16	.16	.10	3.4
June ...	24.30	.41	57.6	76.0	66.0	87	37	80.7	51.3	24	20	29	14	.03	.03	2.4
July....	24.36	.34	64.0	82.5	74.2	96	52	88.7	59.7	38	33	40	21	.71	.30	2.9
Aug ...	24.36	.33	58.5	78.1	69.3	93	44	83.7	54.9	38	33	49	24	1.38	.28	3.4
Sept....	24.37	.47	48.9	68.9	61.3	84	35	76.0	46.6	28	30	46	28	.68	.18	3.2
Oct.....	24.34	.56	36.5	50.6	46.7	71	24	60.6	32.9	25	31	63	49	1.41	.57	3.1
Nov	24.43	.82	28.7	38.7	37.4	65	11	49.9	25.0	17	19	63	48	.57	.54	1.4
Dec	24.39	.76	26.0	33.5	31.8	51	12	42.3	21.2	15	18	64	54	.65	.45	4.7
Means .	24.31	.60	41.1	55.6	49.7	96	—13	62.7	36.7	22	23	50	36	0.10	......	3.6

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

MOBILE, ALA.

[H=35. T=87. h=81].

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	8.7	31	N.	S.	17	3	5	16	17	3	0	1	0	2	17	12	5	0	0	0	0	0
Feb	9.1	34	SE.	S.	14	2	1	7	21	3	4	4	0	4	16	8	5	0	0	0	0	0
Mar	10.6	35	SW.	N.	17	3	3	10	12	8	2	7	0	8	14	9	14	0	3	0	0	0
Apr	9.3	27	SE.	SE.	9	3	5	12	11	9	3	8	0	8	13	9	8	0	0	0	1	0
May	8.1	27	SW.	S.	11	11	3	8	16	7	1	5	0	9	13	9	11	0	0	0	4	0
June	7.1	36	NE.	NW.	3	5	2	5	10	11	10	14	0	2	20	8	13	0	0	6	3	0
July	6.5	27	SW.	NW.	5	10	2	6	13	6	6	14	0	5	13	13	19	0	0	9	5	0
Aug	6.9	29	NW	N.	20	8	2	8	11	7	4	7	0	4	24	3	12	0	0	2	1	0
Sept	6.0	35	SE.	N.	22	6	9	3	7	3	3	4	3	4	19	7	15	0	0	0	1	0
Oct	7.0	85	NW.	N.	21	3	4	3	8	7	6	6	4	13	12	6	10	0	0	0	0	0
Nov	6.8	24	N.	N.	33	1	2	4	8	5	3	3	1	13	13	4	3	0	0	0	0	0
Dec	8.5	30	N.	N.	23	1	2	3	17	4	2	7	3	9	16	6	5	0	1	0	1	0
Means	94.5	....	......	N.	195	51	40	85	151	73	44	80	11	81	190	94	120	0	4	17	16	0

MONTGOMERY, ALA.

[H=217. T=68.81. h=60.49.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan	5.7	26	E.	E.	9	5	14	11	5	6	6	4	2	5	14	12	11	0	1	0	2	0
Feb	6.0	28	SW.	SW.	7	8	7	4	8	10	5	3	4	9	7	12	10	0	1	0	3	0
Mar	7.1	30	SW.	SW.	11	5	6	8	5	14	2	9	2	11	9	11	15	0	4	0	4	0
Apr	5.7	23	S.	SW.	2	3	8	5	8	16	10	8	0	9	12	9	8	0	0	0	1	0
May	4.8	20	SW.	E.	6	4	14	9	5	14	5	5	0	8	15	8	15	0	0	0	6	0
June	3.8	20	E.	SE.	5	2	7	12	4	10	11	9	0	8	14	8	15	0	0	18	17	0
July	4.7	80	SE.	SE.	9	1	4	13	4	12	11	7	1	5	13	13	15	0	0	20	8	0
Aug	4.5	18	SW.	SE.	12	5	8	12	4	9	6	6	0	6	16	9	16	0	0	13	8	0
Sept	4.5	28	S.	E.	5	9	13	4	1	9	11	8	0	5	8	17	18	0	0	4	9	0
Oct	4.5	24	W.	W.	8	6	9	0	3	8	12	6	10	19	4	8	10	0	0	0	0	0
Nov	2.9	22	S.	NW.	5	6	3	6	5	3	3	7	22	20	7	3	3	0	0	0	0	0
Dec	5.4	25	NW.	NW.	6	5	10	4	4	9	9	12	3	13	11	7	4	0	4	0	1	0
Means	5.0	....	......	SW.	85	59	103	88	56	120	90	84	44	118	130	117	140	0	10	55	59	0

MONTROSE, COLO.

[H=5705. T=42[illegible]. h=33[illegible].]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
Jan	5.1	36	NE.	S.	4	3	1	9	27	5	4	6	3	15	9	7	8	12	25	0	0	0
Feb	7.1	40	S.	S.	5	1	4	10	28	3	1	3	1	12	11	5	5	2	23	0	0	0
Mar	5.8	36	SE.	S.	4	4	1	15	21	3	3	6	2	10	8	13	5	3	19	0	0	0
Apr	6.3	35	S.	S.	7	7	0	10	20	5	5	5	1	11	11	8	8	0	5	0	0	0
May	7.0	25	SW.	S.	7	1	1	7	26	4	4	12	0	17	13	1	3	0	1	0	1	0
June	7.4	30	NW.	S.	4	1	1	11	23	4	8	7	1	24	3	3	1	0	0	0	1	0
July	5.8	32	S.	S.	6	1	2	14	27	1	4	4	3	24	6	1	8	0	0	12	9	0
Aug	5.4	30	NW.	S.	6	1	0	13	24	0	6	12	0	23	4	4	13	0	0	3	4	0
Sept	5.0	21	NW.	S.	5	2	0	16	24	0	0	10	3	17	12	1	8	0	0	0	0	0
Oct	5.0	33	NW.	S.	5	1	1	13	31	0	2	4	5	21	6	4	7	0	13	0	0	0
Nov	5.3	34	SW.	SE.	3	1	1	25	24	2	1	3	0	26	2	2	3	0	27	0	0	0
Dec	3.9	26	NW.	S.	4	5	5	17	21	2	1	6	1	11	12	8	4	0	30	0	0	0
Means	5.8	....	......	S.	60	28	17	160	299	29	39	78	20	211	97	57	73	17	143	15	15	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

MOORHEAD, MINN.

[Lat., 46° 51′ N.; long., 96° 50′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.14	1.38	—4.3	2.6	—0.9	40	—31	8.2	-10.0	—8	0	86	88	.26	.10	5.1
Feb	29.07	1.16	0.2	7.4	4.8	47	—26	15.7	- 6.1	—4	3	84	82	.40	.16	5.9
Mar	29.06	1.20	12.8	21.7	18.2	44	—22	26.5	9.9	9	16	83	81	.56	.28	5.9
Apr	29.02	1.08	35.6	52.5	44.6	82	10	58.4	30.9	28	30	76	45	.19	.09	4.9
May	28.86	1.02	42.4	55.1	48.0	84	14	60.5	35.5	33	34	73	49	1.42	.44	6.3
June	28.87	.69	62.6	73.0	67.6	91	44	77.8	57.5	58	60	85	67	6.60	1.72	6.2
July	28.94	.67	62.5	75.4	69.2	98	46	81.3	57.1	57	62	83	65	3.59	1.54	4.3
Aug	28.97	.72	55.2	69.7	62.7	93	36	75.4	50.0	50	56	85	64	3.69	1.08	5.2
Sept	29.00	1.04	45.0	59.5	54.6	86	30	67.3	41.9	42	48	89	69	2.62	1.13	4.3
Oct	28.88	1.01	38.9	46.8	44.8	76	24	53.2	36.4	35	37	87	70	2.10	.84	7.5
Nov	29.02	1.15	26.2	38.5	32.6	63	2	42.7	22.6	22	27	83	78	.31	.31	4.6
Dec	29.01	.97	14.0	20.4	19.1	47	—18	29.6	8.6	10	12	84	74	.05	.02	4.0
Means	28.99	1.01	32.6	43.1	38.8	98	—31	49.7	27.9	28	32	82	69	21.79	......	5.4

NANTUCKET, MASS.

[Lat., 41° 17′ N.; long., 70° 6′ W.]

Jan	30.16	1.59	37.6	38.5	34.6	56	17	41.7	27.5	32	34	82	83	3.52	.90	6.5
Feb	30.09	1.09	36.8	36.6	35.6	55	12	41.2	30.0	31	32	82	84	2.72	.90	6.2
Mar	29.97	1.20	35.8	37.2	35.7	54	14	40.6	30.8	31	32	82	84	6.07	1.40	6.4
Apr	30.08	1.06	44.9	43.4	43.6	58	30	48.7	38.0	36	38	72	82	1.17	.38	5.2
May	29.99	.64	53.9	52.1	51.9	67	36	56.9	46.9	48	47	81	84	2.48	.68	6.3
June	29.97	.62	61.5	59.3	60.4	75	49	65.8	54.9	55	55	81	85	3.49	2.84	5.1
July	30.03	.60	69.0	65.4	67.2	82	55	72.7	61.6	63	62	82	89	2.90	2.57	3.9
Aug	30.02	.58	68.0	66.9	67.7	80	55	72.7	62.7	62	63	82	88	2.81	.92	4.9
Sept	30.12	.68	65.0	63.5	63.8	77	48	68.3	59.3	59	59	81	86	8.33	2.21	5.1
Oct	29.86	1.07	53.7	52.5	52.5	70	41	56.1	48.9	45	46	74	80	6.72	2.05	6.9
Nov	30.02	.94	45.1	44.9	44.0	60	25	49.3	38.8	40	40	82	82	.89	.71	4.8
Dec	30.00	1.21	31.5	32.4	31.1	52	11	38.1	24.1	26	28	81	86	2.70	1.10	5.8
Means	30.03	.94	50.2	49.4	49.0	82	11	54.3	43.7	44	45	80	84	43.80	......	5.6

MOUNT KILLINGTON, VT.

[Lat., 43° 28′ N.; long., 72° 49′ W.]

Jan	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Feb	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Mar	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Apr	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
May	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
June	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
July	26.11	.52	51.9	53.5	54.0	72	34	60.5	47.5	48	48	86	82	4.26	2.54	......
Aug	26.09	.62	48.9	51.2	51.6	73	34	57.6	45.6	46	47	89	86	7.97	2.26	......
Sept	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Oct	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Nov	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Dec	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Means	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

MOORHEAD, MINN.

[H=935.14. T=54.25. h=44.33.]

Months and years.	Wind.													Number of days—									
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	8.6	42	S.	NW.	13	3	0	3	11	5	1	16	10	11	8	12	6	26	31	0	0	1
Feb	11.5	48	N.	N.	22	2	0	4	10	4	0	10	4	8	6	14	11	21	28	0	0	0
Mar	11.9	50	S.	NW.	15	6	0	6	14	2	1	17	1	8	8	15	10	16	31	0	0	0
Apr	14.0	46	S.	S.	21	4	0	7	22	3	0	2	1	9	13	8	5	0	18	0	0	0
May	12.2	44	NE.	N.	16	11	1	8	10	0	1	14	1	8	8	15	13	0	11	0	2	0
June	10.3	38	SE.	SE.	14	5	2	16	10	5	1	7	0	7	7	16	17	0	0	1	9	0
July	9.5	75	NW.	SE.	13	1	7	16	12	2	3	7	1	14	14	3	12	0	0	2	6	0
Aug	10.6	40	S.	N.	13	4	3	12	12	3	5	9	1	13	6	12	11	0	0	1	5	0
Sept	11.3	36	SE.	S.	11	6	5	10	12	3	4	7	2	16	6	8	8	0	1	0	2	0
Oct	12.2	36	W.	NW.	6	2	2	12	10	10	5	15	0	1	12	18	11	0	10	0	0	0
Nov	10.8	35	NW.	S.	8	1	1	1	15	11	11	12	0	13	8	9	2	7	27	0	0	0
Dec	11.1	44	NW.	S.	12	2	0	4	13	9	12	9	1	16	11	4	3	16	31	0	0	0
Means	11.2	....	......	N.	164	47	21	90	151	57	44	125	22	124	107	134	109	86	188	4	24	1

NANTUCKET, MASS.

[H=14.0. T=42.64. h=37.55.

Jan	13.4	48	NW.	W.	10	3	5	5	3	9	15	12	0	10	7	14	14	4	20	0	0	0
Feb	14.1	48	NW.	NW.	4	8	5	5	9	8	3	14	0	10	6	12	14	3	14	0	0	0
Mar	13.5	48	E.	NW.	12	9	2	3	4	8	8	16	0	7	11	13	18	3	15	0	1	0
Apr	12.1	38	N.	NE.	6	17	4	3	1	15	8	6	0	12	9	9	10	0	3	0	1	0
May	12.6	60	NE.	SW.	4	7	8	5	7	24	2	4	1	7	9	15	12	0	0	0	2	0
June	9.0	30	E.	W.	6	5	8	6	5	11	13	6	0	11	8	11	13	0	0	0	4	0
July	9.1	36	N.	SW.	7	5	3	0	8	18	16	5	0	16	7	8	8	0	0	0	2	0
Aug	8.6	34	SW.	SW.	4	4	3	7	5	16	14	9	0	11	13	7	10	0	0	0	0	0
Sept	9.7	38	NE.	W.	4	6	6	4	2	16	16	5	1	12	6	12	13	0	0	0	1	0
Oct	13.5	54	NE.	N.	14	10	6	6	7	3	8	7	1	7	6	18	17	0	0	0	1	0
Nov	10.8	36	NE.	SW.	7	2	3	2	9	14	12	11	0	12	11	7	10	1	4	0	0	0
Dec	15.0	48	SE.	NW.	6	2	6	1	2	7	13	24	1	10	7	14	16	9	24	0	0	0
Means	11.8	....	......	SW.	84	78	59	47	62	149	128	119	4	125	100	140	155	20	80	0	12	0

MOUNT KILLINGTON, VT.

[H=4056. T=5.02. h=2.06.]

Jan	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
Feb	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
Mar	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
Apr	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
May	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
June	......	....	......	......	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
July	23.5	75	NW.	W.	5	1	1	0	2	15	22	16	0	7	14	10	12	0	0	0	2	0
Aug	23.1	61	SW.	NW.	7	4	1	0	6	15	13	16	0	4	14	13	18	0	0	0	0	0
Sept	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
Oct	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
Nov	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
Dec	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
Means	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

NASHVILLE, TENN.

[Lat., 36° 10′ N.; long., 86° 47′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature 8 a. m.	Temperature 8 p. m.	Temperature Mean (max. and min.).	Temperature Maximum.	Temperature Minimum.	Temperature Mean. Maximum.	Temperature Mean. Minimum.	Dew-point. 8 a. m.	Dew-point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan.	29 68	.84	45.2	50.1	49.0	75	20	56.6	41.4	41	41	85	72	8.10	2.78	7.5
Feb	29.52	.79	44.5	51.2	49.2	77	23	57.6	40.9	40	42	86	72	10.95	2.62	7.2
Mar	29.53	1 07	40.1	47.8	45.7	79	16	54.1	37.3	30	32	70	50	8.64	2.21	6 5
Apr	29.54	.74	55.4	63.2	60.2	82	37	69.1	51.4	45	46	71	56	3.84	.92	5.9
May	29.41	.63	60.6	69.6	65.8	89	37	75.6	56.0	53	54	78	60	4.16	1.12	5.6
June	29.48	.30	75.3	80.9	79.8	98	62	90.0	69.5	67	68	76	65	2.23	1.24	4.7
July	29.46	.43	74.4	83.7	80.0	98	60	90.5	69.4	64	62	71	50	.46	.25	4.1
Aug	29.51	.35	70.1	76.6	75.2	95	54	83.9	66.5	64	64	82	68	6.59	1.66	5.8
Sept	29.51	.31	62.6	71.1	70.2	90	49	78.4	61.9	61	63	80	77	5.86	2.15	6.7
Oct	29.46	.64	52.8	60.6	59.3	86	32	68.6	50.0	48	47	85	63	3.01	2.22	5.2
Nov	29.58	.45	46.1	55.6	53.6	78	29	63.3	43.8	40	40	81	59	2.01	.92	4.3
Dec	29.58	.78	37.3	44.1	42.6	67	22	51.7	33.4	30	34	78	68	4.12	1.72	5.7
Means	29.52	.62	55.5	62.9	60.9	98	16	70.0	51.8	49	49	79	64	59.97	......	5.8

NEW HAVEN, CONN.

[Lat., 41° 18′ N.; long., 72° 56′ W.]

Jan.	30.08	1.34	32.0	36.8	35.4	65	10	43.3	27.4	26	30	81	76	3.07	1.69	6.6
Feb	30.00	1.18	32.3	35.4	35.5	67	10	43.1	27.9	27	30	80	81	3.19	.90	6.4
Mar	29.90	1.00	31.4	34.4	31.2	67	4	41.3	27.0	25	28	78	78	6.60	1.48	6.6
Apr	29.99	1.13	44.3	47.3	47.0	70	24	56.0	37.9	35	38	71	72	2.89	.72	4.8
May	29.87	.70	55.5	56.4	56.8	79	38	65.2	48.5	48	50	79	81	4.24	.95	5.8
June	29.87	.57	64.9	66.0	65.9	88	48	74.7	57.1	56	57	75	75	3.12	1.57	6.1
July	29.92	.53	69.1	69.4	69.4	91	49	78.4	60.4	60	61	75	76	6.59	2.54	5.5
Aug	29.90	.69	67.9	68.9	69.1	85	47	76.6	61.6	62	63	82	82	2.67	1.18	6.8
Sept	30.02	.64	60.7	62.6	62.8	80	36	71.2	54.5	56	58	85	86	5.38	1.60	5.7
Oct	29.78	1.03	49.1	50.6	51.3	73	33	58.4	44.2	43	41	80	80	7.63	1.97	6.8
Nov	29.93	.78	39.1	41.6	41.7	69	17	49.3	34.1	32	34	76	76	.67	84	4.7
Dec	29.93	1.15	24.2	26.7	26.6	51	5	33.9	19.4	16	19	71	76	2.00	1.36	5.3
Means	29.93	.90	47.5	49.7	49.6	91	4	57.6	41.7	40	43	78	78	48.95	......	5.9

NEW LONDON, CONN.

[Lat., 41° 21′ N.; long., 72° 5′ W.]

Jan.	30.13	1.38	34.8	38.0	36.6	62	14	43.8	29.5	27	20	75	72	3.31	1.57	6.6
Feb	30.06	1.18	34.6	37.0	36.8	65	14	43.3	30.4	27	28	74	72	2.40	.80	6.4
Mar	29.95	1.12	34.2	36.4	36.1	64	7	42.7	29.5	26	26	73	68	8.60	1.65	6.6
Apr	30.03	1.05	46.4	47.7	47.2	70	28	51.8	39.7	33	36	62	67	4.86	1.68	5.1
May	29.92	.68	56.0	55.7	56.3	77	42	62.6	50.0	47	50	74	80	4.51	1.45	6.3
June	29 92	.56	65.0	65.5	65.3	87	51	72.4	58.2	55	57	72	76	2.94	1.67	6.3
July	29.97	.53	69.8	69.3	69.7	88	53	76.8	62.6	61	61	75	77	3.07	82	5.8
Aug	29.95	.68	68.4	68.7	69.6	83	51	75.6	63.5	62	62	80	79	2.43	.81	5.7
Sept	30.07	.66	62.6	63.7	64.2	78	40	70.4	58.0	57	58	82	82	5.51	1.90	5.6
Oct	29.84	1.06	50.6	52.1	52.0	74	36	57.9	46.2	43	44	77	74	6.43	1.38	6.3
Nov	29.98	.82	41.7	43.0	43.2	65	18	49.6	36.8	33	33	72	70	.86	.32	4.7
Dec	29.98	1.16	27.6	30.5	29.4	52	8	36.4	22.5	17	19	65	63	3.93	1.40	5.8
Means	29.98	.91	49.3	50.6	50.5	88	7	57.2	43.9	41	42	73	78	48.85	......	5.8

Annual Meteorological Summary for the Year Ending December 31, 1890—Continued.

NASHVILLE, TENN.

[H=553. T=96.5. h=82.9.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	7.6	28	SE.	SE.	4	6	10	15	13	0	6	8	0	2	13	16	16	0	9	0	0	0
Feb	7.1	36	S.	SE.	6	4	3	13	3	3	11	7	6	4	6	18	13	0	7	0	4	0
Mar	8.6	46	E.	NW.	7	3	10	6	7	2	13	14	0	6	11	14	14	4	11	0	3	0
Apr	7.0	30	SE.	S.	6	10	9	6	15	3	3	7	1	8	10	12	12	0	0	0	2	0
May	4.6	34	SW.	S.	9	6	7	6	18	8	0	8	0	10	12	9	14	0	0	0	6	0
June	4.4	29	SW.	NW.	6	6	4	6	7	11	6	14	0	8	20	2	10	0	0	19	11	0
July	4.6	18	NW.	S.	7	11	5	5	13	6	5	9	1	15	12	4	7	0	0	17	2	0
Aug	4.0	24	SW.	NE.	7	16	4	4	9	7	6	8	1	11	7	13	14	0	0	7	7	0
Sept	3.5	17	N.	NE.	13	15	2	9	5	5	2	8	1	4	14	12	12	0	0	1	1	0
Oct	4.5	25	NW.	NW.	1	6	3	3	8	4	9	20	8	11	13	7	9	0	1	0	1	0
Nov	4.4	30	W.	SE.	8	1	3	14	9	4	4	13	4	16	6	8	7	0	4	0	0	0
Dec	6.0	26	NW.	NW.	3	1	14	6	6	6	3	19	4	11	8	12	9	0	13	0	0	0
Means	5.5	....	......	NW.	77	85	74	93	113	50	68	135	26	106	132	127	137	4	45	44	37	0

NEW HAVEN CONN.

[H=107. T=118. h=110.]

Jan	9.0	60	NW.	SW.	10	9	1	2	2	14	11	12	1	6	9	16	17	6	20	0	0	0
Feb	7.8	39	W.	NW.	8	11	5	2	4	6	5	12	3	5	11	12	16	4	16	0	0	0
Mar	8.0	34	N.	NW.	9	5	2	2	8	5	9	15	7	3	13	15	18	5	20	0	2	0
Apr	6.9	34	NW.	NW.	9	9	3	1	9	8	2	10	9	15	6	9	9	0	4	0	4	0
May	6.6	30	S.	S.	8	6	2	12	15	8	2	7	2	9	12	10	14	0	0	0	3	0
June	5.9	26	NW.	S.	1	8	6	4	1[illegible]	6	8	11	0	7	14	9	11	0	0	0	5	0
July	6.1	25	NW.	SW.	12	4	1	5	14	17	4	5	0	10	13	8	10	0	0	2	5	0
Aug	6.4	27	S.	NW.	6	10	0	4	13	6	8	14	1	5	11	15	10	0	0	0	3	0
Sept	5.5	25	S.	NW.	7	11	3	1	9	8	2	14	5	13	3	14	13	0	0	0	5	0
Oct	6.4	40	W.	NE.	8	18	3	2	2	3	9	11	6	5	11	15	18	0	0	0	3	0
Nov	7.2	44	SW.	NW.	8	0	1	0	7	13	12	16	3	9	13	8	7	2	11	0	0	0
Dec	9.9	52	NE.	NE.	6	18	0	0	0	9	15	12	2	12	9	10	13	11	28	0	0	0
Means	7.1	....	......	NW.	92	109	27	35	99	103	87	139	39	99	125	141	156	28	99	2	30	0

NEW LONDON, CONN.

[H=47. T=29. h=58.]

Jan	8.9	36	NW.	NW.	9	1	1	3	2	16	8	20	2	6	10	15	15	5	17	0	1	0
Feb	7.8	48	SW.	NW.	11	4	4	3	1	6	4	15	8	6	10	12	13	2	14	0	0	0
Mar	7.4	40	NE.	NW.	9	1	4	2	1	9	10	22	4	5	14	12	16	4	15	0	2	0
Apr	7.6	27	NW.	NW.	7	5	6	3	5	14	4	15	1	11	11	8	12	0	4	0	3	0
May	8.4	30	S.	S.	10	2	5	12	13	9	1	10	0	5	13	13	14	0	0	0	1	0
June	6.2	24	NW.	SW.	6	6	7	7	7	11	5	10	1	7	13	10	10	0	0	0	5	0
July	6.2	48	S.	SW.	6	3	2	10	9	18	3	9	2	10	12	9	12	0	0	0	2	0
Aug	6.6	34	SW.	SW.	8	3	2	9	5	14	4	14	3	4	21	6	11	0	0	0	2	0
Sept	6.1	29	SW.	SW.	8	6	7	3	3	12	6	11	4	12	6	12	15	0	0	0	2	0
Oct	7.3	42	E.	N.	16	8	6	2	1	3	8	16	2	6	12	13	20	0	0	0	1	0
Nov	7.4	30	NW.	NW.	7	3	0	0	2	17	8	21	2	11	13	6	9	0	8	0	0	0
Dec	9.7	36	NW.	NW.	10	7	0	1	1	7	12	23	1	10	11	10	11	10	25	0	0	0
Means	7.5	....	......	NW.	107	49	44	55	50	136	73	186	30	93	146	126	158	21	83	0	18	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

NEW ORLEANS, LA.

[Lat., 29° 58′ N.; long., 90° 4′ W.]

Months and year.	Pressure (actual).		Temperature.					Mean.		Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.)	Maximum.	Minimum.	Maximum.	Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	5.0
Jan	30.18	.47	60.2	64.5	65.1	82	36	72.7	57.5	58	61	93	88	.66	.23	4.0
Feb	30.03	.64	58.0	64.9	64.0	82	40	72.9	55.1	55	58	91	77	2.27	.79	4.5
Mar	30.05	.72	55.6	61.4	61.6	80	30	69.8	53.5	50	52	82	73	1.45	.90	5.5
Apr	30.06	.38	66.3	70.3	70.3	84	56	78.1	62.5	61	60	85	72	3.46	1.86	5.9
May	29.92	.50	71.0	74.3	74.4	87	59	81.9	66.8	65	65	82	74	5.32	1.71	....
June	30.00	.31	77.9	79.4	80.6	94	69	88.0	73.3	72	71	83	76	7.71	3.08	5.7
July	29.97	.36	79.4	79.9	81.6	96	68	88.6	74.5	72	72	80	79	6.59	1.67	6.0
Aug	30.00	.29	78.2	80.2	80.6	91	67	87.2	74.0	72	72	81	77	3.62	1.58	5.4
Sept	29.97	.22	74.3	76.7	77.6	89	56	84.2	70.9	69	69	84	79	2.85	1.06	5.2
Oct	29.99	.59	64.3	68.8	69.0	87	49	76.3	61.7	60	60	85	75	5.24	2.63	3.6
Nov	30.10	.37	58.1	65.0	64.0	81	44	71.6	56.5	52	54	82	70	.42	.22	3.3
Dec	30.16	.71	49.9	57.1	56.4	80	35	65.0	47.7	44	46	80	70	2.58	1.74	4.4
Means	30.04	.46	66.1	70.2	70.4	96	30	78.0	62.8	61	62	84	76	42.17	......	4.9

NEW YORK CITY, N. Y.

[Lat., 40° 43′ N.; long., 74° W.]

Jan	80.01	1.22	37.3	41.2	40.2	69	15	47.9	32.6	29	30	72	67	2.95	1.52	6.5
Feb	29.91	1.12	36.0	39.1	40.4	69	17	48.5	32.4	30	31	78	74	3.86	1.11	6.8
Mar	29.83	1.06	33.7	38.5	37.5	71	6	44.3	30.7	27	28	77	67	6.67	1.26	6.8
Apr	29.91	1.17	45.7	52.3	51.0	81	30	60.0	42.0	35	36	67	58	2.58	.61	5.0
May	29.79	.70	56.6	60.1	60.6	80	42	69.1	52.2	48	51	74	72	3.11	.56	6.5
June	29.80	.54	66.2	70.7	70.4	89	5[illegible]	78.7	62.1	56	59	72	69	4.19	1.47	5.1
July	29.85	.52	69.1	73.5	73.4	95	56	81.1	65.8	61	62	75	68	3.96	1.33	5.5
Aug	29.83	.67	68.4	72.0	72.3	89	51	78.9	65.7	62	63	79	74	4.06	1.15	6.4
Sept	29.94	.57	62.9	66.3	66.8	86	46	74.0	59.6	57	58	81	76	8.21	5.12	5.8
Oct	29.71	1.01	52.0	54.7	55.5	74	38	61.7	49.3	44	44	74	70	6.46	1.86	6.7
Nov	29.87	.76	41.0	45.3	45.9	71	18	52.8	39.0	35	36	80	72	.82	.37	5.2
Dec	29.86	1.09	27.8	31.1	31.4	54	13	38.4	21.3	19	22	72	72	5.43	2.11	5.7
Means	29.86	.81	49.7	53.7	53.8	95	6	61.3	46.3	42	43	75	70	52.30	......	6.0

NORFOLK, VA.

[Lat., 36° 51′ N.; long., 76° 17′ W.]

Jan	30.24	.92	48.0	51.1	51.2	76	25	59.4	43.0	40	42	76	72	1.13	.33	6.3
Feb	30.09	.76	48.9	52.3	52.4	79	30	61.2	43.7	43	42	80	70	1.98	.65	5.8
Mar	30.05	1.04	46.0	48.2	48.0	81	22	56.4	39.7	38	37	74	66	4.06	1.39	6.3
Apr	30.10	1.02	54.1	57.4	57.4	84	38	67.0	47.8	43	45	68	66	3.70	1.10	4.9
May	29.95	.62	64.9	67.0	67.4	86	47	75.6	59.1	58	59	78	77	4.03	1.11	6.1
June	29.98	.57	74.6	75.9	77.0	95	58	85.9	68.1	66	65	75	71	2.79	1.02	4.4
July	30.02	.56	75.4	75.5	77.0	96	60	84.3	59.6	66	67	73	76	6.33	2.70	5.4
Aug	30.04	.47	72.0	73.4	75.2	93	58	82.6	67.9	66	67	82	82	9.36	1.69	4.7
Sept	30.09	.46	70.2	70.3	72.4	89	59	78.6	66.1	65	65	84	84	6.64	1.86	5.7
Oct	20.91	.80	57.7	59.9	61.2	88	37	67.8	54.6	52	54	82	80	3.96	1.24	4.7
Nov	30.09	.65	48.3	52.3	52.8	79	30	60.8	44.7	43	44	82	74	.23	.21	4.0
Dec	30.07	1.23	33.6	41.9	41.4	64	25	48.9	33.8	34	36	83	79	6.01	2.50	4.5
Means	30.05	.76	58.2	60.4	61.1	96	22	69.0	53.2	51	52	78	75	50.22	......	5.2

Annual Meteorolgical Summary for the Year Ending December 31, 1890—Continued.

NEW ORLEANS, LA.

[H=54. T=111.75. h=111.17.]

Months of year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	9.5	30	SE.	SE.	9	9	6	24	2	7	2	0	3	8	17	6	7	0	0	0	0	0
Feb	9.4	30	NW.	SE.	5	9	3	17	8	7	1	2	4	14	8	6	5	0	0	0	0	0
Mar	10.2	36	SE.	SE.	8	8	3	25	6	5	1	3	3	15	8	8	7	0	2	0	1	0
Apr	9.4	34	NW.	SE.	5	4	3	22	7	6	3	6	4	8	12	10	11	0	0	0	1	0
May	7.7	35	NW,	SE.	3	12	4	14	11	7	6	4	1	8	11	12	14	0	0	0	8	0
June	6.8	25	NW.	S.	4	2	6	9	15	6	11	7	0	8	14	8	14	0	0	8	5	0
July	6.0	42	N.	SE.	3	3	9	15	8	5	10	4	5	5	16	10	15	0	0	17	6	0
Aug	6.3	36	NW.	E.	4	14	10	9	9	3	4	3	6	7	16	8	12	0	0	1	6	0
Sept	6.7	29	S.	E.	10	8	9	9	6	4	7	4	3	8	14	8	12	0	0	0	1	0
Oct	8.0	36	W.	SE.	3	9	14	13	1	4	12	5	1	17	8	6	7	0	0	0	0	0
Nov	8.5	27	S.E	N.	12	18	9	10	1	4	1	5	0	18	7	5	4	0	0	0	0	0
Dec	9.5	27	SW.	SE.	8	7	8	12	5	7	3	10	2	14	11	6	8	0	0	0	1	0
Means	8.2	....	......	SE.	74	103	84	179	79	65	61	53	32	130	142	93	111	0	2	26	29	0

NEW YORK CITY, N. Y.

[H=185. T=183.4. h=154.9.]

Jan	12.4	55	NW.	NW.	10	2	1	1	11	13	8	16	0	6	10	15	12	2	15	0	0	0
Feb	12.4	45	SW.	NW.	13	5	1	0	9	5	11	12	0	5	9	14	9	1	11	0	0	0
Mar	13.1	38	SW.	NW.	10	1	1	1	10	10	8	21	0	4	13	15	20	4	15	0	1	0
Apr	11.0	42	NW.	NW.	1	10	1	10	9	10	4	15	0	11	11	8	13	0	3	0	4	0
May	10.3	36	W.	SE.	3	5	4	24	6	4	7	9	0	5	14	12	15	0	0	0	5	0
June	9.4	38	W.	S.	6	8	5	9	9	8	7	8	0	9	13	8	9	0	0	0	9	0
July	9.3	34	NW.	S.	2	2	0	15	19	8	2	14	0	10	11	10	10	0	0	4	3	0
Aug	9.8	34	S.	NW.	5	6	4	12	10	9	1	15	0	3	17	11	12	0	0	0	9	0
Sept	9.1	25	N.	S.	6	11	2	9	10	11	2	9	0	9	8	13	11	0	0	0	5	0
Oct	12.0	44	NW.	NW.	9	11	2	4	4	6	12	14	0	5	11	15	15	0	0	0	1	0
Nov	11.4	42	NW.	NW.	5	3	0	3	10	17	13	9	0	8	17	5	5	1	4	0	0	0
Dec	15.1	48	NE.	NW.	11	8	1	2	7	5	16	12	0	7	16	8	13	7	23	0	0	0
Means	11.3	....	......	NW.	81	72	22	90	114	106	91	154	0	82	150	133	144	15	71	4	37	0

NORFOLK, VA.

[H=43. T=88. h=80.]

Jan	9.7	42	NW.	SW.	9	6	0	4	9	17	5	5	7	9	5	17	10	0	6	0	0	1
Feb	10.3	42	SE.	SW.	9	11	2	8	9	12	1	4	0	8	10	10	12	0	2	0	1	0
Mar	13.2	48	SW.	SW.	8	8	4	6	11	11	7	7	0	6	15	10	11	0	9	0	1	0
Apr	10.0	48	E.	NE.	10	15	3	5	10	7	2	8	0	12	10	8	15	0	0	0	1	0
May	9.4	34	S.	S.	6	8	10	10	12	9	4	2	1	5	20	6	15	0	0	0	5	0
June	7.4	33	NW.	S.	7	7	10	7	9	12	6	2	0	14	11	5	7	0	0	8	5	0
July	8.6	32	NE.	S.	3	12	5	13	11	16	0	2	0	10	13	8	14	0	0	4	4	0
Aug	7.7	30	SE.	S	6	4	1	5	16	19	3	7	1	10	15	6	17	0	0	2	7	0
Sept	7.9	34	NE.	S.	8	12	10	8	10	4	0	6	2	6	15	9	13	0	0	0	1	0
Oct	9.4	40	NW.	NW.	8	8	7	2	5	12	4	15	1	12	11	8	11	0	0	0	1	0
Nov	7.1	30	W.	NE.	10	9	3	0	16	6	4	11	1	16	9	5	3	0	2	0	0	0
Dec	9.9	42	NW.	N.	13	5	2	1	13	8	6	14	0	14	9	8	9	0	11	0	0	0
Means.*	9.2	....	......	SW.	97	105	57	69	131	133	42	83	13	122	143	100	137	0	30	14	26	1

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

NORTHFIELD, VT.

[Lat., 44° 10′ N.; long., 72° 41′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
								Mean.								
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Maximum.	Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	*	°	%	%	In.	In.	
Jan	29.17	1.42	18.3	22.8	20.5	61	−10	30.0	11.0	13	16	81	76	2.76	.57	7.6
Feb	29.10	1.41	20.5	24.1	22.2	56	− 7	31.8	12.5	14	16	76	74	3.29	1.05	7.2
Mar	29.02	1.02	22.5	26.8	25.0	59	−13	33.2	16.7	17	20	81	75	2.54	.72	7.0
Apr	29.12	1.02	38.3	41.3	39.1	71	17	50.0	28.2	26	30	64	66	1.94	.57	5.6
May	29.02	.75	52.0	54.0	51.8	73	24	62.0	41.7	43	45	73	72	4.32	.98	7.0
June	29.04	.51	61.5	62.4	60.6	83	36	71.2	50.1	53	54	74	76	2.84	1.14	6.2
July	29.08	.64	65.1	65.5	62.6	89	38	73.8	51.4	57	58	76	78	2.87	.63	6.5
Aug	29.08	.63	61.6	62.8	62.4	88	36	72.9	52.0	55	56	80	80	6.98	1.98	6.6
Sept	29.20	.62	53.4	55.9	56.0	79	37	65.3	46.7	49	52	85	80	2.95	.66	6.7
Oct	28.97	.95	41.0	44.2	44.0	74	21	52.2	35.8	37	38	86	80	3.49	1.04	7.0
Nov	29.04	.76	30.3	32.0	31.6	58	9	39.8	23.5	25	26	81	78	2.28	1.30	6.9
Dec	29.06	1.18	8.1	11.7	8.9	41	−22	18.0	−0.2	1	5	73	75	1.91	.64	7.4
Means	29.08	.91	39.4	42.0	40.4	89	−22	50.0	30.8	32	35	78	76	38.17	......	6.8

NORTH PLATTE, NEBR.

[Lat., 41° 8′ N.; long., 100° 45′ W.]

Jan	27.13	.90	10.3	21.1	18.8	66	−12	30.5	7.1	5	11	79	67	.35	.14	4.9
Feb	27.08	.94	17.7	26.8	27.2	69	−16	39.1	15.2	12	16	77	60	.38	.18	5.9
Mar	27.07	.89	26.5	41.6	36.4	73	4	49.5	28.4	19	22	73	50	.27	.18	5.5
Apr	27.11	.78	40.9	56.9	49.9	85	20	62.4	37.4	34	35	77	49	4.46	2.84	5.1
May	27.01	.68	50.0	65.0	58.1	92	28	71.8	44.9	41	42	72	45	.90	.32	5.
June	27.02	.70	62.3	76.2	69.6	98	39	82.3	56.9	55	54	78	48	2.06	1.30	5.3
July	27.08	.49	68.2	84.5	77.4	103	53	91.1	63.6	60	58	76	43	.39	.18	5.0
Aug	27.12	.54	60.9	77.7	71.4	100	45	85.3	57.4	54	54	78	46	2.42	.70	5.0
Sept	27.14	.75	49.4	68.9	63.0	96	30	79.7	46.3	43	44	80	42	.19	.17	4.4
Oct	27.08	.75	38.7	54.1	50.9	81	21	66.8	35.0	30	29	70	41	.84	.64	4.9
Nov	27.22	.87	26.5	39.9	38.8	77	6	54.5	23.0	18	22	70	72	.42	.42	2.8
Dec	27.16	.80	20.6	34.2	34.3	70	4	50.2	18.4	10	15	65	48	.03	.01	3.5
Means	27.10	.76	39.3	54.2	49.6	103	−16	63.6	35.7	32	34	75	40	12.71	......	4.8

OKLAHOMA CITY, OKLA.

[Lat., 35° 26′ N.; long. 97° 33′, W.]

Jan	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Feb	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Mar	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Apr	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
May	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
June	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
July	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Aug	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Sept	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Oct	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Nov	28.87	.76	39.3	51.6	49.4	82	25	61.1	37.6	35	39	84	66	5.57	3.30	3.8
Dec	28.85	1.09	35.7	44.2	43.7	74	9	53.8	33.6	27	30	74	60	1.02	.39	4.9
Means	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

NORTHFIELD, VT.

[H=877. T=15.10. h=2.3.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	11.2	54	W.	S.	18	9	0	0	26	2	3	3	1	1	11	10	17	16	30	0	0	0
Feb	12.4	48	N.	S.	17	2	5	1	26	3	2	0	0	3	11	14	16	13	24	0	0	0
Mar	9.3	36	N.	N.	18	9	2	0	17	4	5	1	6	5	10	16	17	13	26	0	0	0
Apr	11.1	48	N.	S.	17	7	1	0	25	8	2	0	0	7	13	10	14	2	19	0	0	0
May	9.7	48	SW.	S.	16	6	2	0	20	6	3	0	0	3	12	16	18	0	4	0	0	0
June	8.9	86	N.	S.	19	3	2	0	24	7	2	2	1	3	18	9	12	0	0	0	3	0
July	8.1	44	W.	S.	10	5	3	0	24	15	1	1	3	1	21	9	16	0	0	0	5	0
Aug	7.8	36	S.	S.	14	10	2	0	17	11	3	1	4	1	17	13	14	0	0	0	3	0
Sept	7.8	32	NE.	S.	10	4	3	1	20	14	5	0	3	3	13	14	18	0	2	0	2	1
Oct	6.1	36	N.	S.	13	7	1	1	19	11	4	2	4	4	12	15	16	0	9	0	0	0
Nov	9.9	40	N.	S.	16	6	1	0	24	6	3	1	3	4	10	16	12	6	26	0	0	1
Dec	9.3	48	NW.	N.	21	4	1	1	20	6	3	4	2	2	13	16	16	27	31	0	0	0
Means	9.3	....	......	S.	189	72	23	4	271	93	36	15	27	37	161	167	186	77	171	0	13	2

NORTH PLATTE, NEBR.

[H=2,841. T=45. h=34.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	7.6	30	NW.	W.	7	2	9	8	4	9	13	10	0	13	13	5	7	17	31	0	0	0
Feb	9.2	42	NE.	NW.	7	5	2	10	9	5	6	12	0	6	15	7	4	9	24	0	0	0
Mar	11.2	42	NW.	NW.	8	2	7	11	4	5	11	14	0	9	15	7	5	3	25	0	1	0
Apr	11.1	60	NW.	SE.	3	8	8	11	6	9	8	7	0	8	12	10	12	0	5	0	1	0
May	11.7	40	NW.	NW.	12	1	4	6	12	4	10	13	0	6	24	1	8	0	2	1	4	0
June	11.7	46	SE.	SE.	4	4	7	13	10	1	10	11	0	5	21	4	7	0	0	6	5	0
July	10.4	36	S.	E.	9	5	18	15	9	3	2	1	0	8	20	3	8	0	0	17	4	0
Aug	9.3	40	N.	SE.	6	8	9	14	10	4	3	8	0	6	21	4	10	0	0	9	6	0
Sept	9.4	37	NW.	SE.	4	3	2	20	13	7	4	7	0	11	15	4	3	0	1	3	3	0
Oct	9.6	44	NW.	W.	4	1	4	7	3	9	18	16	0	12	12	7	4	0	9	0	1	0
Nov	8.4	34	N.	W.	5	1	2	0	3	11	24	14	0	20	6	4	1	1	28	0	0	0
Dec	8.1	46	NW.	W.	8	1	3	6	11	4	27	7	0	17	10	4	3	3	31	0	0	0
Means	9.8	....	......	W.	72	41	75	121	94	71	136	120	0	121	184	60	72	33	156	36	25	0

OKLAHOMA CITY, OKLA.

[H=1,239. T=54.15. h=44.55.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
Feb	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
Mar	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
Apr	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
May	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
June	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
July	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
Aug	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
Sept	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
Oct	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..
Nov	7.1	36	N.	N.	20	5	0	4	3	14	5	7	2	16	8	6	7	0	6	0	1	0
Dec	9.0	34	N.	N.	19	2	0	7	11	17	1	4	1	10	15	6	7	2	15	0	1	0
Means	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

OLYMPIA, WASH.

[Lat., 47° 3′ N.; long., 122° 53′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a. m.	Dew-point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.86	1.14	31.3	35.4	32.6	52	7	37.5	27.8	29	33	94	90	8.36	1.35	7.8
Feb	29.94	1.17	32.5	39.8	36.2	55	12	42.3	30.0	30	36	93	86	7.71	1.60	6.3
Mar	29.97	1.27	39.1	47.7	43.6	56	31	50.6	36.7	38	43	94	85	3.78	.00	7.5
Apr	30.06	.87	39.2	56.9	48.3	80	28	59.5	37.1	37	47	92	71	1.49	.51	4.6
May	30.00	.86	45.1	66.7	56.4	82	34	69.4	43.5	43	51	92	60	.31	.17	3.3
June	30.01	.60	49.4	66.1	58.0	88	37	68.9	47.2	47	56	93	70	1.96	.45	5.7
July	30.03	.38	50.6	71.8	61.2	89	42	73.4	49.0	49	57	93	60	.45	.20	3.9
Aug	30.01	.49	52.5	71.8	61.6	90	46	73.8	49.5	51	58	94	63	.39	.38	2.6
Sept	30.01	.42	46.0	66.8	56.1	80	36	68.9	43.3	44	52	94	61	.07	.05	3.5
Oct	30.05	.64	44.0	54.4	49.4	66	30	57.2	41.5	43	58	95	80	2.56	.61	5.9
Nov	30.17	.68	41.4	50.2	46.3	61	31	53.3	39.3	40	46	95	86	.71	.20	6.0
Dec	29.96	1.20	42.3	46.2	44.2	54	32	48.8	39.6	40	42	94	86	8.11	2.75	7.9
Means	30.01	.81	42.8	56.2	49.5	90	7	58.6	40.4	41	47	94	75	35.8	......	5.5

OMAHA, NEBR.

[Lat., 40° 16′ N.; long., 95° 56′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a. m.	Dew-point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
Jan	29.00	1.12	14.1	20.6	18.2	52	—14	26.1	10.3	9	12	79	70	1.44	.76	6.0
Feb	28.92	1.06	19.3	28.3	25.2	64	—12	33.5	17.0	13	18	76	68	.54	.18	6.2
Mar	28.91	1.25	26.3	34.9	32.6	65	1	41.5	23.8	20	23	77	66	1.35	.72	6.4
Apr	28.88	1.00	46.2	60.8	55.2	86	23	65.9	44.4	36	36	70	42	1.55	1.06	5.5
May	28.73	.66	53.2	64.7	60.1	89	33	71.0	49.2	43	43	68	48	2.72	.52	5.7
June	28.75	.71	68.2	79.1	74.4	98	52	81.5	64.3	61	61	79	55	5.04	1.85	5.1
July	28.82	.4	71.7	83.0	78.8	105	55	88.7	68.8	62	62	74	52	3.74	2.97	4.2
Aug	28.88	.47	74.1	74.6	71.0	99	48	81.2	60.9	57	57	78	57	1.62	.41	5.3
Sept	28.91	.82	54.8	66.6	62.7	94	36	73.0	52.4	50	50	83	55	2.50	1.41	5.3
Oct	28.81	.81	44.2	55.8	52.2	76	26	62.2	42.2	38	40	81	58	1.09	.31	5.3
Nov	28.96	1.00	34.0	45.5	42.2	70	20	52.1	32.2	29	32	81	61	1.01	.61	4.1
Dec	28.96	.98	27.1	36.8	34.6	74	5	44.5	24.6	20	21	77	55	.08	.08	4.5
Means	28.88	.86	43.6	54.2	50.6	105	—14	60.4	40.8	36	38	77	57	22.08	......	5.3

OSWEGO, N. Y.

[Lat., 43° 29′ N.; long., 76° 35′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a. m.	Dew-point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
Jan	29.75	1.30	28.7	31.8	29.6	64	0	37.5	21.8	24	27	86	83	4.46	.95	8.9
Feb	29.68	1.22	26.7	29.9	28.6	60	5	36.0	21.3	23	25	86	83	3.25	1.06	8.3
Mar	29.65	1.15	27.6	30.3	28.7	57	2	34.1	23.3	21	23	78	75	1.85	.48	7.2
Apr	29.72	1.21	40.9	43.9	42.9	74	28	50.2	35.6	31	33	70	69	2.16	.98	4.9
May	29.58	.73	48.7	52.1	50.8	77	33	58.0	43.5	42	43	79	73	4.61	1.35	6.5
June	29.60	.62	64.0	65.7	64.9	86	45	72.3	57.5	57	58	78	76	2.43	.86	5.2
July	29.63	.58	67.6	68.6	68.6	93	51	76.0	61.3	58	59	72	72	3.18	1.42	4.9
Aug	29.64	.54	64.7	66.7	66.4	92	50	73.5	59.4	56	57	73	72	2.19	.63	5.4
Sept	29.75	.61	57.1	60.3	59.4	84	36	66.1	52.6	52	52	82	75	6.83	2.92	5.9
Oct	29.54	.98	47.9	49.6	49.4	71	33	54.1	44.7	42	42	79	77	4.64	.94	7.7
Nov	29.63	1.02	36.2	37.8	37.3	64	18	43.2	31.4	30	30	79	75	4.13	1.83	7.6
Dec	29.67	1.18	18.6	22.6	20.4	42	1	26.6	14.1	14	17	86	79	1.63	.50	8.6
Means	29.65	.93	41.1	46.6	45.6	93	0	52.3	38.9	38	39	79	76	40.86	......	6.8

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31 1890—Continued.

OLYMPIA, WASH.

[T=36. T=461. h=40.6.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	5.1	24	S.	S.	7	7	3	2	33	7	1	2	0	3	7	21	25	6	19	0	0	0
Feb	4.8	21	N.	S.	3	14	1	1	23	9	2	2	0	8	5	15	19	2	16	0	0	0
Mar	3.9	21	W.	S.	9	2	1	1	25	8	7	9	0	4	9	18	23	0	5	0	0	0
Apr	4.0	16	W.	S.	6	4	1	1	17	7	8	16	0	13	11	6	11	0	6	0	0	0
May	4.1	22	W.	NE.	10	11	3	0	10	10	9	9	0	17	10	4	3	0	0	0	0	0
June	4.0	16	SW.	S.	7	2	3	2	18	11	11	6	0	10	7	13	16	0	0	0	0	0
July	3.9	14	W.	NW.	8	3	2	2	12	11	10	14	0	16	7	8	5	0	0	0	0	0
Aug	3.1	14	N.	NW.	15	5	2	3	7	9	4	16	1	15	13	3	3	0	0	0	0	0
Sept	2.3	12	N.	N.	24	7	4	3	5	5	4	7	1	18	8	4	2	0	0	0	0	0
Oct	3.9	20	SW.	S.	4	6	2	3	28	10	2	5	2	11	5	15	17	0	3	0	0	0
Nov	2.5	12	SW.	S.	8	5	3	2	20	10	3	4	5	6	13	11	9	0	3	0	0	0
Dec	4.9	24	SW.	S.	3	2	1	5	34	10	2	5	0	3	7	21	19	0	0	0	0	0
Means	3.9	....	......	S.	104	68	26	25	232	106	63	95	10	124	102	139	151	8	52	0	0	0

OMAHA, NEBR.

[H=1,133. T=88.28. h=82.80.]

Jan	8.3	32	NW.	NW.	13	0	1	7	11	3	2	23	2	8	12	11	11	18	28	0	0	0
Feb	9.5	38	NW.	NW.	11	2	0	6	13	2	0	20	2	8	8	12	8	11	25	0	0	0
Mar	10.5	44	NW.	N.	21	2	3	12	7	0	0	16	1	6	11	14	10	8	23	0	0	0
Apr	10.2	36	NW.	SE.	11	6	5	11	10	3	0	11	3	10	18	7	6	0	1	0	0	0
May	10.4	40	NW.	NW.	12	4	1	6	15	5	0	16	3	7	18	6	12	0	0	0	3	0
June	8.4	38	E.	S.	4	1	2	17	18	4	3	10	1	10	13	7	12	0	0	11	7	0
July	8.5	28	S.	S.	10	8	4	10	20	3	0	6	1	16	10	5	8	0	0	15	2	0
Aug	6.8	28	SE.	S.	18	3	1	14	19	1	1	3	2	7	18	6	11	0	0	5	0	0
Sept	7.0	31	NW.	S.	11	2	1	11	18	2	0	6	9	11	13	6	7	0	0	2	0	0
Oct	7.6	36	NW.	S.	10	4	1	8	15	4	1	14	5	12	9	10	9	0	2	0	0	0
Nov	6.6	28	NW.	N.	17	1	1	3	10	10	3	14	1	16	7	7	3	2	14	0	0	0
Dec	7.2	36	NW.	S.	13	3	2	3	20	4	3	13	1	14	11	6	1	7	26	0	0	0
Means	8.4	....	......	S.	151	36	22	108	170	41	13	152	31	125	143	97	98	46	119	33	12	0

OSWEGO, N. Y.

[H=335. T=76. h=83.]

Jan	14.0	52	W.	S.	5	4	2	13	15	5	6	11	1	0	5	26	21	10	26	0	0	0
Feb	14.0	48	W.	SE.	8	4	3	12	9	3	9	8	0	3	5	20	13	10	23	0	0	0
Mar	12.3	40	NW.	NW.	9	1	2	9	11	6	11	13	0	4	8	19	17	11	24	0	1	0
Apr	11.6	41	N.	W.	13	1	0	12	7	7	13	7	0	14	7	9	10	0	9	0	1	0
May	9.2	39	S.	W.	10	2	1	11	9	5	16	5	3	5	12	14	19	0	0	0	2	0
June	7.8	32	N.	W.	7	2	2	9	15	5	15	4	1	10	10	10	5	0	0	0	6	0
July	9.1	36	N.	S.	8	0	3	13	14	7	12	4	1	11	13	7	10	0	0	1	5	0
Aug	9.4	34	W.	SE.	11	6	0	13	10	3	8	9	2	8	12	11	13	0	0	2	3	0
Sept	8.5	29	N.	SE.	10	6	3	18	11	2	5	2	3	10	7	13	12	0	0	0	2	0
Oct	10.1	42	W.	SE.	8	8	4	15	7	5	4	10	1	3	9	19	16	0	0	0	0	2
Nov	12.3	36	NW.	S.	8	2	0	7	23	4	3	13	0	5	5	20	15	4	16	0	0	0
Dec	13.8	40	NW.	SE.	6	4	5	20	7	5	3	12	0	1	4	26	16	21	31	0	0	0
Means	11.0	....	......	SE.	103	40	25	152	138	57	105	98	12	74	97	194	167	56	129	3	20	2

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

PALESTINE, TEX.

[Lat., 31° 45′ N.; long., 95° 40′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a.m.	8 p.m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a.m.	8 p.m.	8 a.m.	8 p.m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.65	.89	52.9	57.8	55.6	70	22	64.1	47.2	49	50	88	77	5.76	2.24	7.4
Feb	29.52	.73	52.0	59.8	57.7	81	19	67.1	48.3	48	47	86	66	4.95	2.15	6.4
Mar	29.50	.94	52.3	61.6	59.2	87	20	69.0	49.3	45	46	79	59	4.94	1.34	6.4
Apr	29.51	.46	59.5	68.9	66.6	85	46	76.5	56.7	54	54	85	62	6.96	2.42	6.5
May	29.40	.44	66.1	76.6	72.3	88	50	82.5	62.1	61	60	85	58	6.85	3.04	4.0
June	29.49	.32	72.8	81.8	78.2	94	56	86.9	69.6	69	68	89	63	3.18	3.15	6.5
July	29.47	.34	76.4	85.6	82.4	97	66	92.6	72.2	72	68	86	58	1.76	1.50	4.8
Aug	29.50	.33	74.4	83.3	81.4	96	66	91.6	71.3	70	67	85	59	2.05	1.56	5.6
Sept	29.49	.31	67.5	74.5	74.2	93	47	84.0	64.5	63	59	86	60	3.42	1.58	6.4
Oct	29.49	.50	57.5	69.1	66.4	88	42	76.9	55.8	52	52	83	56	9.01	4.59	4.9
Nov	29.61	.49	51.1	61.8	59.2	80	37	69.7	48.7	44	46	79	59	1.91	1.91	4.6
Dec.	29.62	.82	46.5	56.4	53.4	81	23	64.0	42.9	40	39	80	64	1.27	.51	6.0
Means	29.52	0.55	60.8	69.8	67.2	97	19	77.1	57.4	56	55	84	61	52.06	......	5.8

PARKERSBURG, W. VA.

[Lat., 39° 16′ N.; long., 81° 36′ W.]

Jan	29.55	.95	40.6	44.0	42.4	70	12	50.8	31.4	36	39	84	84	4.80	0.98	6.4
Feb	29.40	.88	40.2	44.7	43.4	70	18	51.7	35.2	36	39	84	81	5.67	1.28	6.9
Mar	29.41	1.16	33.5	38.7	36.7	69	4	43.8	29.6	28	31	82	76	6.95	1.45	7.7
Apr	29.44	.97	49.0	56.7	53.5	81	29	64.9	42.1	41	46	75	70	3.41	1.40	5.3
May	29.29	.63	59.2	63.2	61.7	87	36	71.9	51.5	51	55	76	75	6.57	1.70	6.2
June	29.35	.52	70.9	75.6	74.4	93	51	85.2	63.6	64	67	78	75	4.84	1.23	5.4
July	29.37	.48	69.6	75.4	73.2	94	52	84.0	62.3	62	65	77	71	6.06	1.86	3.5
Aug	29.40	.51	66.2	70.9	70.0	93	45	79.5	60.6	61	64	83	78	5.84	1.19	5.9
Sept	29.44	.39	59.9	64.6	65.0	86	42	74.4	55.5	57	60	90	84	8.41	2.71	6.1
Oct	29.28	.97	50.2	55.3	51.6	82	31	62.1	47.0	47	50	88	82	3.85	1.20	7.4
Nov	29.43	.60	42.0	46.8	45.8	76	22	53.9	37.6	35	38	79	75	2.57	0.62	6.2
Dec.	29.42	.81	30.3	33.8	32.9	54	15	39.4	26.4	25	27	81	78	4.20	1.83	7.0
Means	29.40	.74	51.0	55.8	54.5	94	4	63.4	45.5	45	48	81	77	62.07	......	6.2

PENSACOLA, FLA.

[Lat., 30° 25′ N.; long., 87° 13′ W.]

Jan	30.21	.86	59.3	64.5	62.8	79	36	68.7	56.9	56	60	90	86	0.65	.56	5.4
Feb.	30.06	.54	59.2	63.9	63.0	76	37	69.5	56.4	56	60	91	86	2.03	.84	4.4
Mar	30.07	.61	55.1	60.4	58.8	80	25	66.2	51.3	50	52	82	76	2.89	.88	5.3
Apr	30.08	.43	66.8	69.5	68.4	81	52	74.6	62.1	61	62	82	78	1.34	1.01	4.9
May	29.92	.52	72.0	73.5	72.8	83	55	79.2	66.4	65	66	80	80	3.14	0.91	5.4
June	30.00	.32	79.4	79.7	79.6	95	70	85.2	74.0	73	73	81	79	2.21	.62	4.7
July	29.97	.42	78.9	80.4	80.1	97	68	86.9	73.3	73	73	83	79	13.68	3.17	5.3
Aug	30.00	.26	78.6	81.1	80.0	92	68	86.9	73.2	72	72	81	74	3.89	1.15	4.2
Sept	29.96	.23	74.4	77.1	76.9	90	54	83.4	70.4	71	70	90	81	6.98	2.84	5.1
Oct	29.97	.59	64.8	68.7	68.1	85	44	75.4	60.8	60	60	84	76	7.76	3.59	3.7
Nov	30.09	.34	56.5	64.0	62.8	80	35	71.1	54.4	51	56	83	76	0.60	.49	3.2
Dec.	30.14	.63	49.6	54.9	54.5	75	33	62.4	46.6	44	47	82	74	1.76	.93	3.1
Means	30.04	.44	66.2	69.9	69.0	97	25	75.8	62.2	61	63	84	79	47.02	......	4.6

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

PALESTINE, TEX.

[H=511. T=42.1. h=38.1.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	8.0	32	NW.	NE.	5	16	4	10	14	7	0	5	1	3	10	18	14	0	5	0	1	0
Feb	8.4	27	SW.	S.	5	12	4	9	12	6	2	6	0	5	9	14	8	0	3	0	6	0
Mar	9.0	30	NW.	NE.	4	18	1	12	17	4	0	6	0	8	8	15	10	0	2	0	4	0
Apr	7.3	27	SW.	S.	2	15	7	5	19	5	3	4	0	7	7	16	12	0	0	0	5	0
May	6.3	24	N.	S.	2	14	2	7	20	11	1	5	0	14	13	4	10	0	0	0	6	0
June	5.9	23	SE.	S.	4	3	5	10	29	8	0	1	0	2	19	9	3	0	0	9	0	0
July	4.6	24	NE.	S.	3	6	4	7	25	12	4	0	1	11	17	3	3	0	0	28	3	0
Aug	4.7	19	NE.	S.	0	10	4	17	20	9	0	1	1	5	22	4	3	0	0	26	2	0
Sept	4.6	25	N.	NE.	10	16	10	11	9	1	1	2	0	6	12	12	11	0	0	9	3	0
Oct	5.3	27	S.	NE.	5	15	4	4	11	8	8	4	3	12	12	7	8	0	0	0	3	1
Nov	5.2	28	S.	NE.	6	17	2	6	10	3	8	8	0	12	11	7	2	0	0	0	0	0
Dec	6.6	24	SW.	S.	5	11	1	9	15	7	3	11	0	10	8	13	7	0	4	0	2	0
Means	6.8	....	......	S.	51	153	48	107	201	81	30	53	6	95	146	122	91	0	14	72	35	1

PARKERSBURG, W. VA.

[H=638. T=75.90. h=67.33.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	7.7	35	W.	S.	3	3	2	2	20	9	5	9	9	9	4	18	17	2	13	0	0	0
Feb	7.3	34	W.	SW.	3	3	2	3	9	9	7	8	12	6	4	18	18	2	13	0	2	0
Mar	8.4	30	W.	NW.	4	10	2	9	4	7	5	15	6	5	5	21	24	7	16	0	0	0
Apr	6.2	36	W.	S.	2	7	9	4	12	9	2	4	11	11	7	12	20	0	3	0	2	0
May	4.8	32	SW.	SW.	1	4	3	8	8	16	9	5	8	9	6	16	22	0	0	0	6	0
June	4.2	38	W.	SW.	5	1	6	6	11	13	11	2	5	8	11	11	17	0	0	6	10	0
July	4.2	32	NW.	S.	4	5	6	7	12	7	9	2	10	19	4	8	9	0	0	8	3	0
Aug	4.4	24	W.	S.	2	3	0	11	15	4	9	11	7	10	8	13	16	0	0	4	5	0
Sept	4.0	24	NW.	S.	5	6	7	9	11	5	4	6	7	10	5	15	16	0	0	0	5	0
Oct	5.2	26	W.	SW.	2	2	3	5	8	20	12	6	4	7	5	19	21	0	0	0	0	0
Nov	6.2	26	W.	SW.	4	9	2	7	8	13	12	4	1	10	5	15	11	0	10	0	0	0
Dec	6.9	30	NW.	NW.	2	1	5	11	12	7	10	12	2	7	7	17	17	5	26	0	0	0
Means	5.8	....	......	......	37	54	47	82	130	119	95	84	82	111	71	183	208	16	81	18	33	0

PENSACOLA, FLA.

[H=56. T=79.1. h=80.0.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	9.4	32	NW.	SE.	1	13	6	22	2	9	2	4	3	7	12	12	6	0	0	0	0	0
Feb	9.4	44	S.	SE.	2	7	2	17	8	14	0	5	1	13	7	8	9	0	0	0	2	0
Mar	11.8	40	SW.	NE.	0	17	2	14	2	16	0	11	0	11	11	9	14	0	2	0	2	0
Apr	12.2	36	SE.	SW.	2	4	3	16	4	24	0	6	1	12	9	9	10	0	0	0	4	0
May	10.2	40	SW.	SW.	2	6	7	6	10	21	2	8	0	9	12	10	12	0	0	0	6	0
June	8.5	31	SW.	SW.	5	0	2	6	18	14	10	8	2	5	21	4	10	0	0	2	7	0
July	7.6	48	SW.	SW.	5	5	7	5	9	0	8	8	6	12	10	9	14	0	0	7	9	0
Aug	8.0	39	S.	N.	12	8	8	10	10	2	5	5	2	13	14	4	13	0	0	2	8	0
Sept	7.6	36	N.	NE.	10	16	8	8	1	4	4	8	1	6	18	6	16	0	0	0	11	0
Oct	8.8	44	SW.	N.	18	8	7	3	1	7	10	10	3	18	7	6	9	0	0	0	2	0
Nov	8.4	25	NE.	N.	19	13	5	10	1	1	4	6	1	18	5	7	8	0	0	0	0	0
Dec	9.5	45	NW.	NW.	14	6	6	5	5	4	6	15	1	16	13	2	4	0	0	0	2	0
Means	9.8	....	......	SW.	85	103	63	122	66	125	51	94	21	140	139	86	122	0	2	11	58	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

PHILADELPHIA, PA.

[Lat., 39° 57′ N.; long., 75° 9′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	30.12	1.11	38.7	42.9	41.8	72	19	49.4	34.3	29	31	70	65	1.83	.60	6.9
Feb	30.01	1.00	37.9	41.8	41.4	69	21	49.0	33.9	31	32	79	69	3.39	1.15	6.6
Mar	29.94	1.26	36.1	39.8	38.8	73	9	46.2	31.5	27	28	72	65	1.61	.92	6.7
Apr	30.01	1.18	47.5	53.9	52.0	81	30	61.4	42.7	35	37	65	57	2.28	.74	5.0
May	29.87	.70	59.1	62.8	62.8	84	39	72.1	53.4	50	50	73	66	2.96	.57	6.2
June	29.89	.57	69.1	74.9	73.6	92	55	83.0	64.2	57	59	68	60	1.30	.60	5.7
July	29.94	.57	71.3	74.5	74.6	97	54	83.4	65.7	62	61	72	64	4.03	1.03	5.7
Aug	29.93	.58	70.0	72.4	73.6	94	51	81.3	66.0	62	64	77	74	3.36	1.28	6.9
Sept	30.03	.50	63.6	66.6	67.2	88	45	74.8	59.6	58	58	81	76	2.31	.64	6.0
Oct	29.81	.94	53.1	55.2	55.5	79	36	61.5	49.5	45	46	76	72	4.82	1.23	6.9
Nov	29.98	.75	41.5	46.6	46.4	70	23	54.0	38.9	34	35	75	65	.80	.36	5.3
Dec	29.97	1.20	29.4	33.0	32.2	52	17	38.3	26.0	20	23	71	67	2.33	.85	6.2
Means	29.96	.86	51.4	55.4	55.0	97	9	62.9	47.1	42	44	73	67	34.02	------	6.2

PITTSBURG, PA.

[Lat., 40° 32′ N.; long., 80° 2′ W.]

Jan	29.27	1.05	40.3	42.9	41.4	71	11	49.9	33.0	36	37	86	81	4.18	1.46	7.6
Feb	29.15	.86	40.0	42.8	42.0	68	16	50.5	33.4	35	35	82	76	5.52	1.69	7.0
Mar	29.14	1.26	33.1	36.9	35.8	68	5	42.7	29.0	29	32	85	82	3.86	.82	7.7
Apr	29.20	1.04	48.2	55.9	52.6	78	28	63.6	41.5	44	49	85	79	4.87	1.40	5.6
May	29.05	.62	58.6	63.7	62.0	86	37	71.4	52.5	54	56	86	78	5.85	.83	6.9
June	29.12	.58	70.8	75.5	73.5	92	47	83.5	63.5	61	62	71	64	3.37	1.24	5.7
July	29.14	.53	70.4	76.2	74.0	94	53	84.1	63.9	59	59	68	56	2.22	.74	4.8
Aug	29.16	.55	67.4	72.4	71.1	94	45	80.0	62.2	58	57	74	61	4.06	.96	6.0
Sept	29.23	.47	60.3	66.5	64.6	89	40	73.5	55.7	54	56	81	70	4.24	1.58	6.0
Oct	29.04	1.01	50.5	55.1	54.2	78	35	61.0	47.5	44	46	80	72	5.66	1.91	7.6
Nov	29.17	.81	42.5	47.1	45.4	73	23	52.3	38.6	35	36	75	66	1.14	.24	6.2
Dec	29.16	.89	30.7	33.5	32.1	52	16	37.8	26.4	25	26	80	74	5.64	2.35	7.5
Means	29.15	.81	51.1	55.7	54.1	94	5	62.5	45.6	44	46	79	72	50.61	------	6.6

PORT ANGELES, WASH.

[Lat., 48° 7′ N.; long., 123° 6′ W.]

Jan	29.84	1.37	28.9	31.7	31.4	46	9	37.8	25.5	28	29	97	91	7.05	1.12	8.1
Feb	29.93	1.31	28.7	35.7	32.5	46	7	39.0	26.0	28	32	96	87	4.76	1.11	7.0
Mar	29.98	1.37	35.0	44.8	40.0	51	28	47.6	32.3	33	40	95	84	1.73	.24	8.5
Apr	30.08	.91	37.1	49.5	43.5	66	28	52.3	34.7	36	43	95	80	1.61	.42	6.3
May	30.04	.81	44.7	56.7	51.4	70	34	60.8	42.0	42	49	91	76	.73	.40	4.2
June	30.02	.69	48.8	57.6	53.8	70	38	61.1	46.4	47	51	92	79	2.71	1.31	6.5
July	30.05	.41	49.8	60.9	56.0	79	43	64.2	47.9	48	52	94	75	1.14	.38	3.9
Aug	30.05	.34	51.8	60.6	56.8	75	44	63.9	49.6	50	54	94	78	.00	.00	3.8
Sept	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Oct	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Nov	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Dec	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Means	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

PHILADELPHIA, PA.

[H=117. T=168. h=166.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calm.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder-storms.	Auroras.
1890.																						
Jan	11.5	46	W.	W.	0	4	8	2	4	11	17	15	1	7	9	15	11	1	13	0	0	0
Feb	11.9	46	SE.	NW.	2	21	1	3	1	13	2	12	1	7	5	16	13	1	11	0	1	0
Mar	13.4	36	NW.	NW.	5	5	0	4	4	10	4	28	2	4	12	15	19	3	16	0	0	0
Apr	10.5	42	NW.	NW.	4	8	0	4	8	12	1	10	4	10	11	9	10	0	1	0	2	0
May	10.5	45	NW.	NW.	4	8	4	16	5	10	4	10	1	8	13	11	16	0	0	0	4	0
June	9.1	34	NW.	NW.	3	7	3	12	3	14	1	17	0	9	10	11	6	0	0	3	4	0
July	9.2	32	NE.	SW.	4	8	0	12	6	17	3	11	1	8	13	10	11	0	0	6	5	0
Aug	9.5	41	SW.	NW.	2	11	3	13	3	13	2	15	0	4	14	13	13	0	0	2	5	0
Sept	9.3	36	NW.	SW.	0	15	1	7	8	12	3	13	1	9	7	14	11	0	0	0	2	0
Oct	11.1	43	NE.	NW.	3	13	3	4	8	7	2	27	0	8	3	20	15	0	0	0	1	0
Nov	10.2	36	NW.	NW.	4	5	3	1	3	21	5	18	0	10	13	7	7	0	4	0	0	0
Dec	13.0	48	NE.	NW.	5	13	1	1	0	14	7	21	0	9	7	15	13	3	25	0	0	0
Means	10.8	....	......	NW.	36	118	27	79	48	154	51	206	11	92	117	156	145	8	70	11	24	0

PITTSBURG, PA.

[H=847. T=130. h=124.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calm.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder-storms.	Auroras.
Jan	6.4	35	NW.	NW.	6	3	4	8	7	10	9	12	3	4	4	23	18	2	12	0	0	0
Feb	5.8	24	N.	N.	10	7	8	7	3	2	9	9	1	5	5	18	15	2	12	0	2	0
Mar	6.2	35	NW.	N.	12	4	5	5	7	7	9	9	4	2	10	19	22	6	20	0	1	0
Apr	4.5	31	NW.	N.	9	5	5	2	7	8	6	7	11	11	7	12	14	0	3	0	5	0
May	4.3	25	N.	SW.	13	4	2	1	9	12	9	5	7	6	8	17	20	0	0	0	4	0
June	3.6	35	SW.	SW.	9	3	5	2	7	7	6	7	14	6	20	4	13	0	0	2	8	0
July	2.9	19	S.	S.	8	3	2	4	9	7	3	4	22	11	15	5	12	0	0	7	8	0
Aug	3.8	24	W.	N.	14	2	2	3	6	6	7	9	13	6	15	10	12	0	0	4	7	0
Sept	4.5	19	SW.	S.	11	1	9	2	7	8	5	6	11	7	14	9	14	0	0	0	4	0
Oct	5.4	25	W.	W.	5	1	5	9	6	8	8	16	4	1	8	22	20	0	0	0	1	0
Nov	5.9	25	SW.	W.	11	3	2	2	12	11	11	6	2	7	9	14	13	0	5	0	0	0
Dec	6.6	27	NW.	W.	10	5	5	5	4	12	11	9	1	4	8	19	18	8	28	0	0	
Means	5.0	....	......	N.	118	41	54	50	84	98	93	99	93	70	123	172	191	18	80	13	39	0

PORT ANGELES, WASH.

[H=14. T=19.8. h=2.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calm.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder-storms.	Auroras.
Jan	2.8	30	NE.	S.	0	4	2	0	28	1	6	1	20	2	7	22	20	6	20	0	0	0
Feb	1.7	16	E.	W.	0	0	3	0	7	0	16	0	30	4	8	16	15	6	25	0	0	0
Mar	3.6	18	W.	S.	0	0	0	0	42	0	14	0	6	0	8	23	15	0	15	0	0	0
Apr	4.6	22	W.	W.	0	0	1	1	21	0	37	0	0	7	9	14	8	0	11	0	0	0
May	4.7	20	W.	W.	0	0	0	0	20	1	41	0	0	14	8	9	5	0	0	0	0	0
June	3.6	12	W.	S.	0	3	1	2	29	1	21	0	1	9	2	19	10	0	0	0	0	0
July	4.4	12	W	W.	0	0	0	0	24	0	35	1	2	18	2	11	7	0	0	0	0	0
Aug	3.9	14	W.	W.	0	0	0	0	26	0	36	0	0	17	4	10	0	0	0	0	0	0
Sept	......	......	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Oct	......	......	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Nov	......	......	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Dec	......	......	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Means	......	......	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

PORT HURON, MICH.

[Lat., 43° N.; long., 82° 26′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hour.	
1890.	*In.*	*In.*	°	°	°	°	°	°	°	°	°	%	%	*In.*	*In.*	
Jan	29.44	1.25	29.6	32.9	32.1	64	4	38.9	25.3	24	27	82	80	3.11	.85	6.9
Feb	29.36	1.06	27.7	31.2	30.0	60	11	35.9	24.2	23	25	84	78	1.76	.36	6.8
Mar	29.36	1.30	25.6	29.0	27.8	51	2	33.5	22.0	20	20	89	71	1.43	.65	6.3
Apr	29.43	1.25	40.5	43.0	43.0	72	22	51.7	34.4	33	31	75	67	2.46	.63	4.3
May	29.26	.80	49.4	50.9	50.8	76	34	58.9	42.7	41	41	74	72	4.30	.90	5.6
June	29.32	.63	65.5	67.6	67.4	94	40	76.3	58.5	58	58	78	73	4.72	1.51	4.6
July	29.34	.63	67.6	70.4	69.5	95	47	78.9	60.1	58	57	73	64	.96	.57	3.7
Aug	29.39	.53	62.8	65.1	64.6	93	44	72.9	56.2	55	55	76	70	4.33	1.98	4.8
Sept	29.46	.66	56.1	59.6	58.7	87	40	66.3	51.1	49	51	78	72	1.23	.38	4.9
Oct	29.25	.98	47.3	49.6	49.9	73	27	56.4	43.4	42	43	83	80	4.92	1.18	7.9
Nov	29.35	.84	36.4	39.2	39.4	63	23	46.0	32.7	30	31	80	73	2.42	1.24	5.7
Dec	29.37	1.01	23.7	26.6	26.0	47	5	32.2	19.7	18	19	80	72	1.31	.38	6.7
Means	29.36	.91	44.4	47.1	46.6	95	2	54.0	39.2	38	38	79	73	32.95	......	5.7

PORTLAND, ME.

[Lat., 43° 39′ N.; long., 70° 15′ W.]

Jan	30.02	1.59	21.2	25.6	23.2	62	−3	30.7	15.8	15	18	77	74	2.89	.99	6.5
Feb	29.96	1.48	25.3	27.4	26.6	58	0	33.7	19.5	19	21	78	78	4.04	1.58	5.8
Mar	28.83	1.19	28.4	31.9	30.7	51	5	37.0	24.4	21	25	75	77	6.24	1.18	6.6
Apr	29.93	1.05	41.6	41.7	42.1	70	24	49.7	34.5	26	30	58	66	2.51	.87	4.2
May	29.84	.77	51.5	50.6	52.1	75	36	58.9	45.3	45	48	81	90	6.10	1.93	6.3
June	29.84	.58	60.4	59.6	60.6	87	46	68.3	52.8	53	54	79	84	4.53	1.32	5.6
July	29.89	.68	66.9	66.0	67.4	93	51	75.6	59.3	59	60	77	82	3.58	1.43	5.1
Aug	29.88	.68	65.1	64.8	65.9	88	49	72.9	58.9	59	60	80	86	2.99	1.07	5.5
Sept	30.00	.69	58.1	59.5	59.7	79	37	66.1	53.3	54	55	86	86	4.88	2.11	5.5
Oct	29.77	1.12	46.3	47.8	47.7	75	32	53.9	41.5	40	42	81	82	6.82	2.33	6.4
Nov	29.87	1.00	34.7	36.8	36.9	60	13	43.7	30.1	28	28	78	73	2.81	1.79	5.6
Dec	29.88	1.39	15.4	18.4	17.0	41	−4	24.5	9.4	10	10	79	72	5.08	1.54	5.6
Means	29.89	1.39	42.9	44.2	44.2	93	−4	51.2	37.1	36	38	77	79	51.97	......	5.7

PORTLAND, OREGON.

[Lat., 45° 32′ N.; long., 122° 43′ W.]

Jan	29.85	1.05	29.1	33.0	31.8	55	12	36.7	26.8	27	29	94	85	11.13	2.38	7.8
Feb	29.91	1.15	35.1	41.5	38.5	60	10	45.1	31.9	32	32	89	71	9.85	3.81	5.9
Mar	29.94	1.18	40.2	49.3	45.2	66	24	52.4	37.9	37	37	89	65	6.23	.96	7.5
Apr	30.01	.82	43.3	60.9	52.4	85	32	63.2	41.7	40	37	88	44	1.41	.61	4.6
May	29.94	.82	50.2	69.5	60.6	87	40	72.5	48.8	48	48	92	50	1.08	.37	8.6
June	29.97	.60	53.5	68.9	61.8	92	45	71.5	52.2	50	52	90	50	2.23	.72	5.5
July	29.97	.37	55.5	75.0	65.5	95	48	76.6	54.4	52	51	87	45	.59	.30	8.5
Aug	29.95	.44	56.6	75.7	65.9	96	48	78.9	51.9	53	54	88	49	.13	.10	3.5
Sept	29.94	.37	52.9	72.7	62.4	81	40	74.6	50.2	50	49	89	45	.10	.10	2.7
Oct	30.02	.54	46.8	58.3	52.6	72	35	61.9	43.3	44	47	93	68	2.79	1.05	4.3
Nov	30.14	.74	42.0	52.0	47.2	73	30	55.8	38.6	40	45	91	77	.50	.18	4.0
Dec	29.96	1.24	40.8	45.7	43.0	57	28	48.8	37.6	39	42	94	86	4.34	.65	7.4
Means	29.97	.78	45.5	58.5	52.2	96	10	61.3	43.2	43	44	90	62	40.38	......	5.0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

PORT HURON, MICH.

[H=639. T=70.4. h=63.2.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	14.1	72	SW.	S.	1	2	0	5	22	8	14	9	1	4	11	16	16	8	24	0	0	0
Feb	13.1	44	SW.	S.	6	7	6	6	9	8	6	8	0	6	8	14	13	8	23	0	0	0
Mar	13.3	48	NE.	N.	12	5	1	6	9	9	9	11	0	8	10	13	13	9	25	0	0	0
Apr	13.1	38	SW.	S.	17	10	4	3	18	1	2	5	0	13	8	9	11	0	7	0	1	0
May	11.8	40	W.	S.	13	9	1	11	14	5	7	1	1	8	13	10	19	0	0	0	5	0
June	8.4	42	NW.	N.	15	13	0	9	13	6	1	3	0	9	17	4	11	0	0	2	8	0
July	10.1	36	N.	S.	10	11	4	1	25	6	3	1	1	16	11	4	6	0	0	1	2	0
Aug	9.5	45	W.	S.	10	7	2	9	13	3	10	8	0	13	9	9	9	0	0	1	3	0
Sept	10.4	37	SW.	S.	8	15	8	3	20	4	3	4	0	12	8	10	9	0	0	0	0	0
Oct	10.8	38	N.	NW.	5	7	8	8	6	7	9	10	2	3	8	20	21	0	3	0	2	0
Nov	11.8	36	S.	S.	8	2	3	2	13	11	10	11	0	9	9	12	10	0	14	0	0	0
Dec	13.1	48	W.	NW.	4	1	8	10	9	7	10	13	0	6	11	14	11	16	27	0	0	0
Means	11.6	....	......	S.	109	89	40	73	171	75	84	84	5	107	123	135	149	41	123	4	21	0

PORTLAND, ME.

[H=99. T=81.2. h=71.3.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	8.0	36	NW.	NW.	15	2	0	0	2	7	13	22	1	7	9	15	15	16	30	0	0	0
Feb	9.7	43	S.	N.	14	2	3	5	6	6	9	9	2	7	10	11	16	13	23	0	0	0
Mar	8.0	31	S.	NW.	14	3	0	1	6	8	9	17	4	8	6	17	19	9	22	0	0	0
Apr	9.2	36	NW.	NW.	6	4	3	2	11	10	9	16	0	12	13	5	9	0	8	0	0	0
May	9.1	37	SE.	S.	9	5	5	4	25	7	2	5	0	8	10	13	17	0	0	0	1	0
June	8.3	27	NW.	NW.	3	11	3	8	5	8	8	11	3	9	11	10	9	0	0	0	2	0
July	7.2	28	S.	S.	5	0	4	4	19	11	6	11	2	9	13	9	7	0	0	2	2	0
Aug	7.6	36	SE.	NW.	4	4	7	3	9	10	6	17	2	9	15	7	11	0	0	0	0	0
Sept	7.2	27	S.	S.	10	6	5	0	13	7	9	10	0	11	8	11	13	0	0	0	0	0
Oct	8.2	33	NE.	N.	14	6	3	2	6	6	8	13	4	7	7	17	14	0	0	0	0	0
Nov	8.1	26	NW.	NW.	11	0	0	2	1	15	12	17	2	11	7	12	6	2	16	0	0	0
Dec	8.9	36	NW.	NW.	16	1	0	0	2	10	14	18	1	10	9	12	15	22	31	0	0	0
Means	8.3	....	......	NW.	120	44	33	31	105	105	105	166	21	108	118	139	151	62	130	2	5	0

PORTLAND, OREGON.

[H=80. T=84.8. h=76.8.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	5.8	36	S.	S.	3	4	11	0	20	1	2	12	0	6	2	23	23	8	19	0	1	0
Feb	7.8	36	S.	S.	3	4	11	2	27	2	1	4	2	6	13	9	16	2	10	0	0	0
Mar	5.2	26	S.	S.	8	3	4	7	21	8	1	8	2	1	13	17	22	0	3	0	0	0
Apr	5.2	30	S.	NW.	12	0	1	6	11	5	2	20	3	13	13	4	9	0	0	0	0	0
May	5.5	24	SW.	NW.	8	1	1	2	10	5	2	17	16	15	11	5	9	0	0	2	0	0
June	6.2	24	S.	S.	13	1	1	2	18	7	4	13	1	9	11	10	18	0	0	1	0	0
July	5.6	24	SW.	N.	25	1	0	4	8	4	2	18	0	18	9	4	4	0	0	1	0	0
Aug	5.6	24	NW.	N.	25	1	1	2	5	1	1	26	0	18	10	3	2	0	0	0	0	0
Sept	4.7	18	NW.	N.	23	4	0	3	1	0	0	24	5	22	8	0	1	0	0	0	0	0
Oct	4.2	27	S.	S.	10	2	4	3	14	10	5	8	6	9	20	2	15	0	3	0	0	0
Nov	3.5	16	S.	N.	12	5	3	3	10	7	3	4	13	16	9	5	8	0	2	0	0	0
Dec	4.9	35	S.	S.	0	0	4	2	27	13	4	8	4	5	7	19	20	0				
Means	5.4	....	......	S.	142	26	41	45	172	63	27	162	52	138	126	101	147	10	37	4	1	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

PUEBLO, COLO.

[Lat., 38° 18′ N.; long., 104° 36′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a.m.	Temperature. 8 p.m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a.m.	Dew-point. 8 p.m.	Relative humidity. 8 a.m.	Relative humidity. 8 p.m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	25.19	.83	22.8	36.0	31.2	70	—2	45.8	16.7	12	14	66	46	.12	.12	3.5
Feb	25.16	.98	23.3	42.4	34.6	71	—14	49.7	19.4	7	7	56	31	1.25	.10	4.2
Mar	25.18	.92	30.8	51.5	43.4	76	—2	58.8	28.0	14	4	54	20	.48	.24	5.5
Apr	25.23	.61	40.4	59.3	50.5	79	20	64.2	36.8	23	16	60	30	2.08	1.12	5.3
May	25.19	.55	49.9	69.3	59.4	89	36	73.1	45.6	38	29	66	29	1.71	.55	4.5
June	25.22	.66	58.6	81.1	69.2	98	41	85.2	53.1	37	56	49	17	.58	.30	4.1
July	25.30	.35	65.6	83.6	76.5	100	54	91.6	61.4	50	44	58	28	.56	.24	5.3
Aug	25.31	.47	60.1	80.0	72.0	100	48	87.1	56.8	48	45	66	33	1.99	1.55	4.3
Sept	25.32	.58	51.3	71.8	63.6	92	36	79.3	47.9	34	32	54	26	.02	.02	4.6
Oct	25.26	.77	37.6	58.8	50.6	79	22	67.0	34.3	17	17	47	24	.20	.12	3.1
Nov	25.39	.88	29.0	46.7	41.0	78	15	56.8	25.1	16	15	61	34	.32	.32	2.6
Dec	25.30	.81	25.8	41.9	36.8	70	9	52.7	20.9	13	10	60	30	T	T	3.4
Means	25.25	0.70	41.3	60.2	52.4	100	—14	67.6	37.2	26	21	58	29	8.31	......	4.2

RALEIGH, N. C.

[Lat., 35° 47′ N.; long., 78° 38′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a.m.	Temperature. 8 p.m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a.m.	Dew-point. 8 p.m.	Relative humidity. 8 a.m.	Relative humidity. 8 p.m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
Jan	29.88	.78	46.0	52.2	51.6	76	23	60.5	42.6	40	40	82	68	.83	.29	6.1
Feb	29.72	.71	47.5	53.1	52.7	80	29	61.5	43.9	43	43	85	70	2.80	.90	6.7
Mar	29.69	.91	44.9	50.2	49.6	79	20	59.8	39.5	36	36	72	61	3.74	1.42	6.1
Apr	29.74	.97	55.0	60.8	59.6	86	31	70.6	48.5	44	44	69	58	1.96	.59	5.0
May	29.58	.62	64.9	69.8	69.4	92	44	80.2	58.5	57	56	77	64	4.16	1.38	4.5
June	29.63	.56	75.7	78.3	78.6	97	58	89.2	68.0	66	65	73	66	2.37	.53	5.2
July	29.66	.57	73.2	75.9	76.6	95	56	85.8	67.5	66	67	81	76	11.23	2.40	5.8
Aug	29.68	.42	71.4	73.6	74.5	92	52	83.4	65.6	65	66	81	78	5.83	2.29	4.7
Sept	29.71	.38	67.6	70.2	71.0	89	51	78.8	63.2	64	65	87	84	3.11	.91	6.6
Oct	29.57	.77	58.7	59.2	60.3	87	34	69.1	51.5	49	51	77	75	3.91	1.65	5.2
Nov	29.73	.56	48.0	54.8	53.8	79	29	63.6	43.9	41	45	79	72	.08	.04	4.0
Dec	29.70	1.16	36.9	43.0	41.3	67	23	50.1	32.5	28	30	72	63	3.57	1.47	4.7
Means	29.69	.70	57.3	61.8	61.6	97	20	71.0	52.1	50	51	78	70	43.57	......	5.4

RAPID CITY, S. DAK.

[Lat., 44° 4′ N.; long., 103° 12′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a.m.	Temperature. 8 p.m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a.m.	Dew-point. 8 p.m.	Relative humidity. 8 a.m.	Relative humidity. 8 p.m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
Jan	26.60	.85	9.1	11.9	12.8	56	—24	23.8	1.8	—1	2	68	68	.47	.32	4.4
Feb	26.57	.90	16.5	24.4	22.5	66	—27	34.9	10.1	6	10	69	60	.66	.29	7.0
Mar	26.57	.93	27.4	36.8	33.4	68	—3	44.1	22.8	18	21	70	57	1.40	.77	7.1
Apr	26.62	.78	39.5	53.8	46.7	82	8	58.6	31.8	27	20	66	44	1.55	.38	5.3
May	26.55	.89	48.0	60.6	53.7	90	25	65.8	41.6	34	33	61	39	2.46	1.31	5.4
June	26.55	.70	59.9	72.1	65.7	90	45	77.6	53.8	46	46	62	44	3.77	1.76	5.7
July	26.62	.62	67.6	83.3	74.5	99	55	87.9	61.1	48	43	52	30	.13	.04	4.7
Aug	26.65	.55	61.6	75.9	69.6	101	46	82.3	57.0	47	44	61	36	1.83	1.18	5.1
Sept	26.66	.76	50.2	65.8	59.7	92	32	73.7	45.7	35	36	58	35	.75	.63	4.3
Oct	26.60	.75	40.9	51.6	48.8	79	25	61.0	36.7	27	28	61	44	.56	.20	5.5
Nov	26.74	.73	35.6	41.3	42.1	75	13	54.3	29.9	21	22	58	50	.27	.22	3.7
Dec	26.64	.89	30.6	32.6	33.6	75	3	45.3	21.8	16	17	60	57	.17	.06	4.8
Means	26.61	.79	40.6	50.8	46.9	101	—27	59.1	34.8	27	28	62	47	14.02	......	5.2

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

PUEBLO, COLO.

[H=4,753. T=23. h=13.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	8.5	46	W.	W.	7	3	14	2	1	3	18	13	1	15	15	1	2	5	29	0	0	0
Feb	10.1	53	N.	W.	8	5	9	4	0	3	18	7	2	9	13	6	3	3	24	0	0	0
Mar	9.4	60	W.	E.	7	1	18	1	1	3	16	11	4	8	18	5	4	1	22	0	0	0
Apr	9.6	48	NW	E.	5	4	21	6	2	2	18	2	0	8	13	9	7	0	9	0	1	0
May	8.0	32	W.	E.	6	5	20	6	1	4	13	5	2	9	19	3	7	0	0	0	3	0
June	8.2	42	NW	W.	4	3	7	6	3	7	17	12	1	8	22	0	5	0	0	10	3	0
July	7.1	36	NW	NW.	13	4	8	3	1	4	9	20	0	4	25	2	6	0	0	18	7	0
Aug	6.4	36	W.	NW.	8	0	15	7	1	0	8	20	3	12	13	6	7	0	0	14	5	0
Sept	7.0	36	W.	E.	3	5	17	2	2	1	14	14	2	10	16	4	1	0	0	3	0	0
Oct	6.7	34	N.	E.	6	5	19	1	1	3	13	13	1	18	7	6	3	0	11	0	0	0
Nov	5.9	30	N.	E.	8	4	17	3	1	1	8	17	1	18	10	2	2	0	27	0	0	0
Dec	7.2	40	N.	NW.	7	4	10	5	0	0	14	21	1	15	14	2	0	1	28	0	0	0
Means	7.8	....	....	E.	82	43	175	46	14	31	166	155	18	134	185	46	47	10	150	45	19	0

RALEIGH, N. C.

[H=388. T=70. h=2.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	7.2	30	NW	SW.	11	8	0	2	11	17	4	5	4	7	12	12	10	0	7	0	0	0
Feb	7.5	30	SW	N.	16	4	1	1	9	15	3	5	2	4	9	15	13	0	4	0	0	0
Mar	9.3	41	SW	SW.	13	6	1	5	10	17	2	7	1	9	8	14	17	0	9	0	4	0
Apr	7.6	27	W.	SW.	9	12	2	0	10	20	1	6	0	10	13	7	10	0	1	0	1	0
May	5.5	24	N.	SW.	10	5	4	4	14	15	3	5	2	13	12	6	12	0	0	1	4	0
June	4.4	24	NE.	SW.	5	6	1	2	11	18	6	4	7	7	19	4	14	0	0	11	7	0
July	4.7	36	NE.	SW.	6	7	5	4	15	20	1	1	3	9	9	13	14	0	0	10	5	0
Aug	4.5	16	S.	SW	11	1	1	1	14	23	3	6	2	12	13	6	12	0	0	1	5	0
Sept	4.8	24	NW	NE.	9	18	2	3	9	12	3	2	2	7	8	15	15	0	0	0	2	0
Oct	6.3	25	SW	NW.	13	7	0	2	2	12	7	17	2	14	6	11	10	0	0	0	1	0
Nov	5.2	23	NW	SW.	4	9	4	0	9	18	5	9	2	15	7	8	4	0	2	0	0	0
Dec	6.8	27	NW	SW.	9	7	1	3	7	18	4	11	2	16	5	11	8	0	14	0	0	0
Means	6.2	....	....	SW.	116	90	22	27	121	205	42	78	20	122	121	122	130	0	37	23	20	0

RAPID CITY, S. DAK.

[H=3,280. T=49.4. h=44.0.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	6.7	48	W.	NE.	9	16	1	1	3	5	6	11	10	12	14	5	7	20	28	0	0	0
Feb	8.8	48	NE.	E.	3	10	12	5	3	7	4	6	6	3	10	15	10	13	25	0	0	0
Mar	9.2	42	NW	N.	11	8	2	6	8	4	8	9	6	0	20	11	18	5	27	0	0	0
Apr	8.8	60	N.	N.	14	11	0	5	6	8	6	6	4	12	8	10	9	0	11	0	1	0
May	11.0	38	N.	N.	22	6	0	11	4	4	5	9	1	4	22	5	12	0	2	1	5	0
June	9.8	50	SW	NW.	10	5	4	10	6	5	9	11	0	7	15	8	15	0	0	1	10	0
July	10.0	36	SE.	SW.	7	9	1	13	7	13	7	5	0	10	16	5	6	0	0	14	3	2
Aug	8.8	60	SW	W.	6	8	5	8	7	7	11	4	6	6	18	7	10	0	0	5	8	0
Sept	8.6	35	S.	NE.	9	15	3	5	4	4	9	7	4	13	13	4	3	0	1	1	2	0
Oct	8.7	38	NW	W.	7	1	2	4	4	8	18	11	7	6	20	5	8	0	6	0	1	2
Nov	8.1	36	NW	W.	2	0	2	3	0	14	21	14	4	15	11	4	5	3	17	0	0	0
Dec	7.4	42	N.	W.	8	0	2	4	0	15	22	4	7	10	15	6	6	7	28	0	0	0
Means	8.8	....	....	W.	108	89	34	75	52	94	123	97	55	98	182	85	109	48	145	22	30	4

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

RED BLUFF, CAL.

[Lat., 40° 10′ N.; long., 122° 15′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a. m.	Dew-point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.72	.73	37.1	43.6	39.2	51	22	45.8	32.6	33	36	86	78	6.55	2.02	6.4
Feb	29.72	.95	41.0	51.0	42.0	66	28	52.5	37.6	35	36	80	61	3.67	1.16	5.8
Mar	29.73	.79	45.1	57.9	50.8	69	34	59.6	42.1	39	38	81	53	6.14	1.71	5.2
Apr	29.68	.64	51.6	69.5	60.3	87	40	71.7	48.9	44	47	77	52	1.70	1.61	3.7
May	29.59	.61	58.0	78.0	67.8	99	42	79.6	55.9	52	55	81	50	2.67	1.67	3.8
June	29.59	.57	69.7	85.3	72.6	104	47	86.5	58.6	49	49	67	30	.11	.06	1.8
July	29.55	.40	66.5	95.4	80.4	110	58	96.2	64.5	47	44	52	19	......	......	0.5
Aug	29.54	.37	67.5	93.9	79.7	104	54	94.9	61.5	52	52	58	25	......	......	1.1
Sept	29.55	.40	62.3	87.5	74.3	99	52	89.2	59.4	45	48	57	30	1.65	1.40	2.0
Oct	19.66	.47	54.2	76.4	65.0	90	43	79.0	51.1	30	42	58	30	.01	.01	2.6
Nov	29.76	.75	47.2	67.4	58.0	88	36	72.3	43.6	32	37	57	35	......	......	2.1
Dec	29.79	1.09	39.8	49.8	45.0	64	29	52.9	37.2	38	43	93	79	3.10	1.48	5.5
Means	29.66	.65	52.6	71.3	61.5	110	22	73.4	49.7	42	44	71	45	25.50	......	3.4

RED WING, MINN.

[Lat., 44° 34′ N.; long., 92° 38′ W.]

Jan	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Feb	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Mar	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Apr	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
May	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
June	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
July	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Aug	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Sept	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Oct.*	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Nov	29.25	29.67	30.4	37.3	35.0	55	7	42.8	27.1	24	28	77	70	.75	.46	4.7
Dec	29.26	29.68	20.2	26.8	24.2	53	—6	31.8	16.7	13	18	74	70	.15	.08	4.9
Means	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

*Station established October 1, 1890, and first observation taken 8 a. m., October 10, 1890.

RIO GRANDE CITY, TEX.

[Lat., 26° 23′ N.; long., 98° 48′ W.]

Jan	29.91	.98	59.0	69.9	67.6	88	34	77.2	58.1	59	61	99	75	1.58	.40	5.5
Feb	29.80	.78	57.8	73.5	68.4	95	30	80.2	56.5	57	61	97	67	.57	.26	4.6
Mar	29.79	1.16	58.9	77.4	71.2	103	24	84.9	57.5	57	58	95	53	.23	.20	5.3
Apr	29.79	.58	68.0	77.9	76.4	97	46	86.5	66.3	66	64	93	64	1.30	.77	7.0
May	29.69	.48	72.5	85.0	81.0	100	62	91.9	70.0	69	68	88	58	2.36	1.03	5.3
June	29.76	.41	75.3	85.6	83.6	102	62	94.6	72.6	71	69	88	60	2.08	.82	4.6
July	29.75	.34	76.9	89.3	86.6	101	70	98.9	74.4	73	67	88	50	1.20	.66	5.0
Aug	29.76	.37	76.3	90.0	86.6	102	71	99.2	73.9	73	68	90	40	.54	.35	4.6
Sept	29.78	.43	71.5	85.3	82.3	100	52	95.2	69.4	67	64	85	51	.39	.25	4.5
Oct	29.80	.63	66.8	78.8	76.9	98	50	87.8	65.5	62	61	85	56	5.48	4.91	5.6
Nov	29.95	.57	55.7	67.8	65.8	91	37	76.9	54.6	51	63	86	61	.51	.33	5.2
Dec	29.99	.85	50.8	65.7	72.0	87	31	75.4	48.7	47	50	88	59	.14	.14	5.8
Means	29.81	.63	65.8	78.8	75.7	104	24	87.4	64.0	63	62	90	59	16.47	......	5.2

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

RED BLUFF, CAL.

[H=342. T=53.5. h=44.2.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	10.3	48	SE.	SE.	4	0	2	27	4	4	1	17	3	8	7	16	22	0	16	0	0	0
Feb	10.2	39	SE.	SE.	5	0	2	19	8	2	4	12	4	9	8	11	13	0	7	0	0	0
Mar	8.6	38	SE.	NW.	4	0	0	16	13	1	2	24	2	11	10	10	16	0	0	0	0	0
Apr	7.8	32	NW.	NW.	4	0	1	15	11	2	3	19	5	16	10	4	3	0	0	0	0	0
May	7.1	26	S.	NW.	4	0	0	19	10	2	2	21	4	17	8	6	7	0	0	7	1	0
June	7.5	31	NW.	SE.	2	0	1	24	4	1	0	22	3	25	5	0	2	0	0	9	2	0
July	6.1	24	SE.	SE.	3	0	2	26	6	0	0	21	4	30	1	0	0	0	0	25	0	0
Aug	5.1	22	NW.	SE.	1	1	2	21	7	6	1	14	0	28	3	0	0	0	0	28	1	0
Sept	4.8	26	NW.	NW.	1	0	0	14	11	4	2	25	3	22	6	2	2	0	0	16	0	0
Oct	7.8	40	NW.	NW.	6	0	0	7	5	2	1	36	5	19	12	0	1	0	0	1	0	0
Nov	6.2	39	NW.	NW.	9	0	0	9	6	0	2	33	1	22	8	0	0	0	0	0	0	0
Dec	5.0	44	SE.	NW.	11	0	0	14	4	1	0	19	13	11	11	9	8	0	3	0	0	0
Means	7.1	......	......	NW.	54	1	10	214	89	25	21	263	53	218	89	58	74	0	26	86	4	0

RED WING, MINN.

[H=758. T=62.77. h=54.8.]

Jan																						
Feb																						
Mar																						
Apr																						
May																						
June																						
July																						
Aug																						
Sept																						
Oct																						
Nov	†2610	33	W.	W.	2	4	6	1	7	8	16	9	7	12	11	7	4	4	24	0	0	1
Dec	6484	48	NW.	W.	1	2	11	5	8	4	18	9	4	14	7	10	4	13	28	0	0	0
Means																						

†17½ days only.

RIO GRANDE CITY, TEX.

[H=230. T=11$\frac{5}{12}$. h=2$\frac{7}{12}$.]

Jan	8.6	34	N.	SE.	12	1	8	21	18	0	0	1	1	5	20	6	10	0	0	0	0	0
Feb	9.6	42	N.	S.	10	2	7	7	28	0	1	1	0	7	18	3	5	0	1	8	0	0
Mar	9.7	30	E.	S.	5	3	13	9	28	0	0	0	4	8	16	7	3	0	2	11	0	0
Apr	10.4	46	NE.	SE.	5	8	9	22	15	0	1	0	0	3	14	13	6	0	0	13	2	0
May	8.8	30	W.	SE.	4	4	9	39	0	0	1	3	2	10	16	5	6	0	0	21	4	0
June	11.1	30	E.	SE.	3	1	9	45	1	0	1	0	0	16	9	5	5	0	0	24	2	0
July	8.5	26	SE.	SE.	0	0	14	45	0	0	0	0	3	13	13	5	7	0	0	29	2	0
Aug	8.6	26	SE.	SE.	0	0	18	44	0	0	0	0	0	12	18	1	5	0	0	31	0	0
Sept	7.4	28	E.	SE.	5	7	14	27	1	0	0	5	1	12	15	3	4	0	0	24	0	0
Oct	7.5	30	W.	NE.	1	18	16	17	0	0	1	3	6	10	10	11	4	0	0	12	0	0
Nov	6.8	27	NW.	NW.	11	5	7	9	1	0	0	14	3	13	9	8	5	0	0	2	0	0
Dec	5.7	28	NW.	E.	4	7	10	9	0	1	4	10	0	11	12	8	2	0	1	0	0	0
Means	8.6	......	......	SE.	60	50	143	204	92	1	18	37	29	120	170	75	62	0	4	175	10	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

ROCHESTER, N. Y.

[Lat., 43° 8′ N.; long., 77° 43′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a. m.	Dew-point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.44	1.36	31.7	33.2	32.7	66	10	40.2	25.2	26	28	79	81	4.83	.76	8.5
Feb	29.37	1.14	29.3	31.7	31.6	65	11	39.4	23.9	23	26	79	80	3.59	.84	8.0
Mar	29.35	1.18	27.8	30.4	29.8	57	7	35.8	23.8	21	25	78	81	2.99	.67	7.3
Apr	29.44	1.18	42.7	46.5	45.8	78	24	55.4	36.1	30	35	62	67	2.17	.75	5.0
May	29.28	.68	51.4	54.3	53.6	78	30	62.2	45.0	41	44	69	71	6.00	1.32	6.9
June	29.32	.64	66.7	68.9	68.0	89	44	77.2	58.7	56	58	70	69	2.66	.74	5.3
July	29.35	.61	68.6	71.3	70.8	94	47	80.2	61.3	56	57	65	63	1.62	.83	5.3
Aug	29.36	.48	64.5	67.9	66.8	95	47	75.2	58.3	55	57	73	69	2.31	.50	6.6
Sept	29.47	.60	57.5	61.1	60.6	87	35	68.8	52.4	51	55	80	81	5.13	2.10	5.8
Oct	29.25	1.00	48.7	49.7	50.4	76	33	56.1	44.8	42	43	78	78	4.77	1.07	8.1
Nov	29.34	1.02	37.5	39.7	39.0	68	21	44.8	33.1	31	32	79	77	4.05	2.26	7.7
Dec	29.36	1.08	22.2	25.9	23.9	45	6	29.8	18.0	17	21	80	82	2.97	.57	8.6
Means	29.36	.61	45.7	48.4	47.8	95	6	55.4	40.0	37	40	74	75	43.09	......	6.9

ROSEBURG, OREGON.

[Lat., 43° 13′ N.; long., 123° 20′ W.]

Jan	29.44	.88	35.0	38.7	36.3	57	21	41.4	31.2	31	32	88	80	12.23	3.05	8.5
Feb	29.49	1.05	36.8	45.3	40.4	61	13	47.4	33.3	34	36	90	72	9.24	2.33	7.5
Mar	29.51	1.07	30.8	53.4	46.2	69	28	55.7	36.7	37	40	92	64	4.68	1.16	7.2
Apr	29.55	.81	41.4	61.8	52.0	86	26	64.4	39.7	38	40	89	49	.98	.56	5.1
May	29.49	.63	48.2	69.4	59.6	86	38	72.2	46.9	45	46	91	46	1.11	.41	4.5
June	29.53	.54	51.1	70.9	61.6	96	42	73.3	50.0	48	47	87	46	1.47	.69	5.3
July	29.51	.31	53.7	77.4	65.8	93	45	79.2	52.5	49	50	85	46	.01	.01	3.3
Aug	29.48	.44	54.6	79.4	67.5	95	48	81.9	53.1	50	50	85	38	.10	.07	2.3
Sept	29.47	.37	47.4	73.6	60.6	89	41	75.0	46.2	43	46	86	40	.53	.53	1.1
Oct	29.57	.49	43.5	64.8	54.3	77	32	66.9	41.7	41	43	92	47	1.11	.40	4.2
Nov	29.66	.69	37.0	54.2	46.3	72	25	57.1	35.5	35	41	93	63	.19	.16	3.3
Dec	29.53	1.22	40.4	48.2	44.4	62	24	51.3	37.5	38	42	92	79	3.00	.95	6.8
Means	29.52	.71	44.1	61.4	52.0	96	13	63.8	42.0	41	43	89	55	31.65	......	4.9

SACRAMENTO, CAL.

[Lat., 38° 35′ N.; long., 121° 30′W.

Jan	30.03	.71	38.7	45.2	42.6	58	29	48.3	36.8	36	37	89	74	6.62	1.40	6.0
Feb	30.02	.88	42.6	50.9	47.4	67	32	54.5	40.4	39	39	87	67	4.06	1.80	4.9
Mar	30.02	.72	47.4	57.5	52.6	69	36	59.8	45.5	44	41	88	57	3.00	.81	5.1
Apr	29.96	.56	51.1	65.5	59.0	80	44	68.8	49.2	46	46	84	53	1.33	.94	2.6
May	29.86	.56	55.9	71.8	65.4	92	46	75.8	55.0	52	53	87	55	1.80	.82	3.4
June	29.87	.46	56.5	77.8	67.8	94	44	80.8	54.9	51	54	81	45	0	0	.5
July	29.83	.39	58.9	88.3	73.8	102	52	89.3	58.2	52	56	79	36	0	0	.2
Aug	29.82	.38	58.9	84.0	72.8	96	51	87.4	58.2	53	58	80	42	T.	T.	.6
Sept	29.83	.36	56.7	79.4	70.4	94	50	85.2	55.5	52	54	84	44	.80	.80	2.5
Oct	29.92	.55	52.9	72.2	63.4	86	44	76.2	50.5	44	50	74	48	T.	T.	1.3
Nov	30.03	.64	43.7	63.7	54.8	78	36	68.8	40.9	36	40	76	43	0	0	.5
Dec	30.08	.97	40.1	46.0	43.2	61	33	48.6	37.9	37	39	90	78	3.34	2.35	7.5
Means	29.92	.60	50.3	66.7	59.4	102	29	70.3	48.6	45	47	83	51	20.95	......	2.9

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

ROCHESTER, N. Y.

[H=622. T=120. h=125.]

Months and year.	Wind. Average hourly velocity.	Wind. Maximum.	Wind. Direction.	Wind. Prevailing direction.	Wind. North.	Wind. Northeast.	Wind. East.	Wind. Southeast.	Wind. South.	Wind. Southwest.	Wind. West.	Wind. Northwest.	Wind. Calms.	Number of days— Cloudless.	Number of days— Partly cloudy.	Number of days— Cloudy.	Number of days— Rainy.	Number of days— Max. below 32°.	Number of days— Min. below 32°.	Number of days— Max. above 90°.	Number of days— Thunderstorms.	Number of days— Auroras.
1890.																						
Jan	11.2	60	W.	SW.	2	3	2	6	2	20	13	13	1	1	7	23	26	9	24	0	0	0
Feb	11.3	42	NW.	NW.	2	6	3	9	4	7	10	14	1	1	8	19	20	7	22	0	0	0
Mar	10.7	36	W.	NW.	4	7	0	4	3	8	16	20	0	2	11	18	22	9	25	0	0	0
Apr	10.2	54	W.	W.	9	4	3	7	1	9	16	11	0	13	6	11	12	0	9	0	0	0
May	8.2	42	W.	NW.	6	7	2	5	9	10	7	15	1	4	13	14	23	0	1	0	2	0
June	8.1	36	W.	NW.	6	2	5	7	6	9	8	17	0	7	14	9	14	0	0	0	4	0
July	8.7	34	W.	NW.	8	1	8	4	6	13	11	15	1	8	15	8	10	0	0	1	4	0
Aug	8.2	28	SW.	NW.	7	6	7	5	1	10	7	18	1	5	11	15	13	0	0	2	4	0
Sept	7.1	30	NW.	SW.	5	6	1	11	5	14	9	9	0	9	11	10	13	0	0	0	1	0
Oct	8.7	30	NW.	NW.	4	7	2	13	4	10	6	16	0	0	9	22	16	0	0	0	0	0
Nov	10.5	38	SW	SW.	5	2	2	4	4	23	5	15	0	4	5	21	18	2	12	0	0	0
Dec	11.1	38	W.	NW.	5	2	1	14	1	11	11	17	0	2	6	23	21	18	28	0	0	0
Means	9.5	....	......	NW.	63	53	31	89	46	144	119	180	5	56	116	193	208	45	121	3	15	0

ROSEBURG, OREGON.

[H=523. T=54. h=47.]

Months and year.	Wind. Average hourly velocity.	Wind. Maximum.	Wind. Direction.	Wind. Prevailing direction.	Wind. North.	Wind. Northeast.	Wind. East.	Wind. Southeast.	Wind. South.	Wind. Southwest.	Wind. West.	Wind. Northwest.	Wind. Calms.	Number of days— Cloudless.	Number of days— Partly cloudy.	Number of days— Cloudy.	Number of days— Rainy.	Number of days— Max. below 32°.	Number of days— Min. below 32°.	Number of days— Max. above 90°.	Number of days— Thunderstorms.	Number of days— Auroras.
Jan	3.4	21	SE.	S.	4	3	8	4	21	9	3	5	5	0	7	24	23	3	13	0	0	0
Feb	3.2	23	S.	W.	2	2	8	2	8	8	9	5	12	2	10	16	18	1	16	0	0	0
Mar	2.7	28	SW.	SW.	5	3	4	3	4	11	5	7	20	4	10	17	16	0	5	0	0	0
Apr	3.8	26	E.	N.	15	6	8	0	1	2	3	9	16	11	8	11	6	0	4	0	0	0
May	3.8	22	N.	NW.	10	4	4	1	3	3	6	12	19	11	13	7	8	0	0	0	0	0
June	4.1	24	S.	NW.	11	4	3	1	4	4	0	14	19	12	6	12	8	0	0	2	0	0
July	4.4	22	S.	N.	17	7	4	0	1	0	8	9	16	17	9	5	1	0	0	2	0	0
Aug	4.0	18	N.	N.	17	7	3	0	1	0	3	8	23	20	8	3	3	0	0	3	1	0
Sept	1.8	22	N.	N.	14	1	0	0	0	1	2	6	36	26	3	1	2	0	0	0	0	0
Oct	2.0	24	S.	W.	6	4	1	0	1	1	9	4	36	14	12	5	10	0	1	0	0	0
Nov	1.5	14	NW.	N.	6	4	3	0	2	2	4	5	34	18	8	4	4	0	11	0	0	0
Dec	2.0	20	S.	S.	2	2	6	2	13	4	3	3	27	6	10	15	14	0	9	0	0	0
Means	3.1	....	......	N.	100	47	52	13	50	45	55	87	263	141	104	120	113	4	59	7	1	0

SACRAMENTO, CAL.

[H=64. T=61. h=57.]

Months and year.	Wind. Average hourly velocity.	Wind. Maximum.	Wind. Direction.	Wind. Prevailing direction.	Wind. North.	Wind. Northeast.	Wind. East.	Wind. Southeast.	Wind. South.	Wind. Southwest.	Wind. West.	Wind. Northwest.	Wind. Calms.	Number of days— Cloudless.	Number of days— Partly cloudy.	Number of days— Cloudy.	Number of days— Rainy.	Number of days— Max. below 32°.	Number of days— Min. below 32°.	Number of days— Max. above 90°.	Number of days— Thunderstorms.	Number of days— Auroras.
Jan	9.0	42	SE.	SE.	8	2	1	26	11	5	1	8	0	13	7	11	17	0	5	0	0	0
Feb	8.9	36	NW.	SE.	8	3	0	16	11	5	1	12	0	10	9	9	9	0	0	0	0	0
Mar	7.7	36	SW.	SW.	10	2	2	11	6	17	2	11	1	12	6	13	14	0	0	0	0	0
Apr	7.3	33	NW.	SW.	1	2	1	6	14	18	2	14	2	18	10	2	4	0	0	1	1	0
May	8.2	28	N.	SW.	7	0	1	15	12	22	0	3	2	17	7	7	5	0	0	2	0	0
June	8.0	27	NW.	SW.	4	0	0	10	13	21	0	8	4	28	2	0	0	0	0	13	0	0
July	6.5	24	SW.	SW.	0	2	1	18	16	19	0	3	3	30	1	0	0	0	0	8	0	0
Aug	6.3	24	SW.	S.	1	0	0	17	21	19	0	2	2	29	2	0	0	0	0	4	0	0
Sept	5.7	24	S.	S.	4	3	0	15	21	6	3	5	3	20	4	6	1	0	0	0	0	0
Oct	5.7	36	NW.	NW.	16	1	4	7	6	2	1	18	7	27	3	1	0	0	0	0	0	0
Nov	3.9	33	N.	N.	21	4	2	10	5	1	2	7	8	28	2	0	0	0	0	0	0	0
Dec	4.6	30	SE.	N.	20	1	2	19	7	2	0	7	4	5	6	20	5	0	0	0	1	0
Means	6.8	....	......	SE.	100	20	14	170	143	137	12	98	36	237	59	69	55	0	5	28	2	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

ST. LOUIS, MO.

[Lat., 38° 38′ N.; long., 90° 12′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
								Mean.								
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Maximum.	Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.60	1.12	35.2	42.2	39.2	74	8	47.3	31.1	31	33	85	71	7.47	3.57	6.0
Feb	29.40	1.00	35.2	42.1	40.2	78	4	48.4	32.0	29	33	80	73	2.86	.82	6.3
Mar	29.50	1.40	33.3	42.1	39.0	69	6	47.4	30.7	24	28	71	60	5.90	2.31	5.4
Apr	29.48	.93	51.8	61.1	57.2	89	30	66.1	48.2	43	45	73	58	4.05	1.51	4.1
May	29.30	.60	59.9	66.3	63.8	90	37	73.5	51.2	50	52	70	62	5.81	2.38	3.9
June	29.41	.53	74.2	82.9	79.4	98	57	89.1	69.6	66	64	75	55	3.18	.89	3.7
July	29.44	.36	74.0	83.8	79.8	98	57	89.7	70.0	61	60	64	46	.87	.14	3.2
Aug	29.48	.52	69.0	77.7	74.7	97	54	83.0	66.4	60	58	73	54	2.43	1.20	4.8
Sept	29.52	.41	58.9	68.2	65.0	92	41	72.9	57.2	52	56	79	67	1.80	.67	5.3
Oct	29.41	.75	51.1	59.9	57.3	89	29	65.3	49.3	44	44	78	68	.86	.28	4.6
Nov	29.55	.71	43.1	51.5	48.6	76	32	56.8	40.5	35	37	74	61	1.55	.08	4.3
Dec	29.56	.89	33.1	39.8	37.6	63	17	44.3	31.0	24	30	72	69	1.82	.82	4.8
Means	29.48	.77	51.6	50.8	56.8	98	4	65.3	48.4	43	45	74	61	37.69	......	4.7

ST. PAUL, MINN.

[Lat., 44° 58′ N.; long., 93° 3′ W.]

Jan	29.22	1.35	6.5	12.5	9.9	42	—22	17.7	2.1	1	8	79	82	.05	.30	5.4
Feb	29.14	1.12	12.7	22.2	18.5	51	—12	26.3	10.2	8	15	84	75	.50	.13	6.1
Mar	29.17	1.08	16.1	26.3	22.4	51	—16	30.5	14.3	11	17	80	68	1.11	.32	5.4
Apr	29.15	1.14	40.0	53.3	47.8	83	19	58.4	37.2	31	32	73	48	1.80	.82	4.8
May	28.97	.72	46.6	57.7	52.2	86	27	62.4	42.1	37	38	72	51	3.66	.73	6.0
June	29.01	.78	65.4	73.3	69.8	94	51	78.0	61.5	59	60	81	65	5.29	.97	5.6
July	29.07	.57	66.4	75.8	71.9	94	51	81.4	62.4	59	61	78	62	1.87	1.08	5.2
Aug	29.12	.65	58.6	69.0	65.0	92	43	75.0	55.1	53	52	83	58	2.20	.67	4.8
Sept	29.16	.91	50.5	61.5	58.2	84	31	68.8	47.5	46	48	85	62	2.73	.58	4.6
Oct	29.04	1.10	40.8	47.8	46.4	71	22	53.3	39.4	36	38	84	69	2.79	1.52	6.7
Nov	29.15	.88	29.4	37.1	35.6	59	9	43.5	27.6	24	26	80	65	.38	.36	4.8
Dec	29.16	.94	19.1	26.2	24.0	53	— 3	32.0	16.0	13	18	78	72	.10	.06	5.2
Means	29.11	.94	37.7	46.9	43.5	94	—22	52.3	34.6	32	34	80	65	23.38	......	5.4

ST. VINCENT, MINN.

[Lat., 48° 56′ N.; long., 97° 14′ W.]

Jan	29.26	1.38	-14.5	—7.8	-10.0	32	—38	—0.8	10.1	-22	-13	74	76	1.08	.59	4.4
Feb	29.23	1.20	—8.2	—0.6	—3.2	38	—36	7.6	-14.0	-13	—5	81	81	.63	.36	4.1
Mar	29.19	1.19	4.0	16.0	11.8	40	—30	21.5	2.1	—1	10	84	79	.95	.44	4.6
Apr	29.17	1.20	32.5	46.8	41.4	75	13	53.6	29.2	26	32	76	50	1.41	.88	5.6
May	29.03	.99	40.0	50.5	45.2	82	15	57.7	32.8	32	32	75	54	1.29	.60	5.9
June	29.00	.62	63.5	74.7	68.8	94	40	80.5	57.2	55	58	74	59	4.08	2.20	5.4
July	29.05	.80	63.0	74.0	68.8	95	43	80.2	57.3	56	58	79	59	2.32	.82	3.9
Aug	29.09	.81	52.0	64.6	60.1	92	30	72.8	47.4	46	50	81	61	2.40	.81	5.1
Sept	29.13	.91	42.1	52.8	51.3	82	29	63.2	39.4	37	41	83	66	3.82	2.42	5.6
Oct	29.00	1.13	38.8	42.9	42.0	78	23	49.6	34.4	31	35	83	74	2.79	1.34	7.9
Nov	29.14	1.19	22.2	29.1	28.4	57	— 2	37.9	18.9	15	18	76	64	.19	.19	4.5
Dec	29.13	1.13	15.1	20.6	19.0	52	—27	29.6	8.4	9	12	78	71	.23	.18	5.0
Means	29.12	1.05	29.0	38.6	32.3	95	—38	46.1	24.5	23	27	78	67	22.09	......	5.2

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

ST. LOUIS, MO.

[H=57.1. T=107. h=99.]

Months and year.	Wind.													Number of days—									
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	12.1	56	SW	SW	7	5	4	7	4	20	10	5	0	9	8	14	14	5	16	0	1	0
Feb	12.0	37	NW	SW	6	7	3	8	3	13	2	14	0	7	7	14	12	4	13	0	2	0
Mar	12.4	60	W.	NW	8	10	3	9	5	6	2	18	1	10	9	12	12	7	15	0	2	0
Apr	13.1	50	S.	SW	4	12	7	8	6	12	4	7	0	12	9	9	14	0	1	0	2	0
May	11.4	49	S.	SW	3	9	3	10	6	17	2	12	0	16	9	6	15	0	0	1	4	0
June	10.5	38	W.	SW	0	3	4	6	2	28	12	4	1	13	16	1	11	0	0	15	5	0
July	9.8	37	SW	SW	3	6	6	8	5	19	5	10	0	18	11	2	4	0	0	15	0	0
Aug	8.8	33	SW	SW	5	11	6	6	4	17	7	6	0	12	9	10	6	0	0	5	3	0
Sept	9.5	34	NW	NE.	8	18	6	6	7	10	1	4	0	12	6	12	10	0	0	2	2	0
Oct	11.6	42	W.	SW	1	4	3	5	3	16	13	17	0	14	6	11	9	0	1	0	0	0
Nov	11.3	36	W.	SW	7	11	1	4	2	17	8	10	0	15	5	10	9	0	1	0	0	0
Dec	12.7	30	NW	SW	6	10	0	6	5	13	6	14	2	11	11	9	7	3	16	0	0	0
Means	11.3	....	.....	SW	58	106	46	83	52	188	72	121	4	149	106	110	123	19	63	38	21	0

ST. PAUL, MINN.

[H=831. T=114. h=108.]

Jan	5.3	26	NW	W.	2	3	7	10	2	6	16	12	4	6	16	9	9	23	31	0	0	0
Feb	8.1	35	W.	W.	5	2	7	11	2	1	14	13	1	6	10	12	10	17	27	0	0	0
Mar	7.8	34	W.	W.	2	3	5	11	3	5	19	12	2	10	12	9	13	13	29	0	0	0
Apr	6.5	27	NW	SE.	6	7	5	20	4	1	0	13	4	10	14	6	8	0	6	0	2	0
May	7.8	35	NW	NW	3	9	4	11	5	4	8	18	0	6	17	8	14	0	4	0	5	0
June	6.6	37	SW	SE.	2	6	8	18	7	6	6	6	1	8	11	11	18	0	0	4	10	0
July	7.0	25	SE.	SE.	5	6	4	23	0	4	9	11	0	6	21	4	13	0	0	3	5	0
Aug	6.7	26	NW	SE.	3	1	7	21	2	6	10	10	2	11	12	8	12	0	0	2	5	0
Sept	6.7	28	NW	SE.	2	1	6	27	2	9	4	7	2	14	4	12	10	0	1	0	7	0
Oct	6.6	29	SW	NW	4	4	4	20	4	7	6	13	1	5	11	15	12	0	7	0	1	0
Nov	6.7	26	NW	NW	1	4	2	12	7	11	5	17	1	9	15	6	3	4	25	0	0	1
Dec	7.0	29	NW	SE.	0	4	2	22	1	13	9	11	0	9	14	8	6	13	30	0	0	0
Means	6.9	....	.....	SE.	31	50	61	206	39	73	106	143	18	100	157	108	128	70	160	8	35	1

ST. VINCENT, MINN.

[H=804. T=20. h=16.]

Jan	8.8	30	N.	N.	27	0	1	3	19	1	5	6	0	13	9	9	18	30	31	0	0	0
Feb	11.0	40	NW	NW	11	0	1	15	4	2	5	16	2	12	11	5	8	26	28	0	0	0
Mar	10.9	38	NW	NW	8	3	6	11	9	6	7	11	1	12	10	9	10	23	31	0	0	3
Apr	11.9	38	SE.	SE.	14	4	7	21	0	1	3	9	1	6	15	9	4	0	19	0	1	1
May	10.9	40	W.	N.	15	9	5	7	3	0	10	11	2	3	19	9	8	0	14	0	1	0
June	9.0	32	S.	S.	7	8	7	7	13	0	7	2	0	8	12	10	10	0	0	3	4	0
July	7.9	28	SE.	W.	9	4	5	12	5	4	14	9	0	14	13	4	11	0	0	1	5	2
Aug	8.9	35	NW	SE.	9	0	3	26	0	2	5	15	2	11	10	10	10	0	1	1	4	3
Sept	9.8	36	NW	SE.	3	2	3	18	4	3	11	16	0	5	16	9	11	0	2	0	4	0
Oct	10.0	30	S.	NW	2	4	6	16	2	6	12	15	0	2	8	21	0	0	18	0	0	0
Nov	10.2	36	NW	NW	1	0	1	11	6	8	16	17	0	13	9	8	1	0	29	0	0	3
Dec	9.5	36	W.	S.	4	1	2	2	21	6	11	15	0	8	15	8	4	18	31	0	0	1
Means	9.0	....	.....	SE.	110	35	47	148	86	48	106	142	8	107	147	111	90	106	109	5	19	13

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

SALT LAKE CITY, UTAH.

[Lat., 40° 46′ N.; long., 111° 54′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	25.61	.92	22.6	27.3	24.8	50	— 2	32.6	16.9	16	19	65	71	3.07	.60	6.0
Feb	25.60	1.04	31.3	36.9	33.7	58	— 6	40.6	26.8	22	24	70	62	2.05	.60	6.4
Mar	25.64	.90	35.4	45.2	39.5	64	0	49.3	29.7	27	28	72	54	1.12	.42	6.5
Apr	25.63	.74	43.8	58.3	50.4	78	28	61.1	39.7	31	31	62	38	.94	.49	4.6
May	25.58	.58	54.6	69.8	61.3	84	40	72.7	49.9	38	37	56	32	.16	.08	3.8
June	25.60	.60	57.6	74.7	64.8	89	38	76.8	52.9	28	37	40	26	.32	.30	2.8
July	25.63	.44	69.6	87.9	77.8	98	52	90.8	64.8	47	49	46	29	.02	.02	1.7
Aug	25.68	.30	64.3	81.4	72.9	100	50	84.7	61.1	45	48	51	34	.79	.58	2.3
Sept	25.68	.58	56.6	74.9	65.0	87	39	78.3	51.6	39	46	53	37	T.	T.	2.0
Oct	25.72	.71	43.5	53.5	48.6	70	30	59.7	36.7	32	36	64	53	1.44	.58	3.7
Nov	25.83	.79	35.5	45.0	41.0	64	24	51.3	30.7	23	28	62	54	T.	T.	3.1
Dec	25.77	.95	32.6	38.1	36.2	57	20	43.9	28.4	24	28	71	69	.42	.22	4.8
Means	25.66	.71	45.6	57.8	51.3	100	— 6	61.8	40.8	32	34	61	47	10.33	......	4.0

SAN ANTONIO, TEX.

[Lat., 29° 27′ N.; long., 98° 28′ W.]

Jan	29.34	.87	54.3	61.1	59.4	81	25	68.2	50.5	51	50	89	70	1.87	1.23	7.6
Feb	29.23	.74	54.0	62.7	60.8	82	24	70.4	51.1	48	47	83	59	2.92	1.37	6.2
Mar	29.22	1.03	53.4	66.7	62.6	93	21	74.1	51.0	47	43	82	48	.98	.46	6.2
Apr	29.23	.47	59.9	71.6	67.9	92	42	77.9	57.9	55	54	85	60	5.22	1.84	6.0
May	29.13	.48	68.4	77.7	74.3	93	55	83.3	65.4	62	63	81	62	2.30	1.60	4.8
June	29.22	.37	72.3	82.2	78.4	95	58	87.1	69.8	66	66	82	59	4.16	3.13	3.3
July	29.21	.35	75.7	88.2	83.4	99	69	94.5	72.2	68	63	78	46	.88	.48	3.8
Aug	29.22	.36	75.3	86.6	83.2	96	68	93.8	72.5	68	64	78	50	1.44	.56	4.6
Sept	29.29	.50	68.3	78.9	76.1	92	46	86.4	65.8	62	62	82	59	5.41	4.71	4.0
Oct	29.24	.59	61.0	72.9	70.1	92	46	81.5	58.7	51	54	69	54	1.92	.94	3.2
Nov	29.37	.56	51.7	63.9	60.9	85	37	72.4	49.4	44	45	76	53	1.02	.54	4.0
Dec	29.39	.88	47.9	60.0	56.7	86	28	67.9	45.5	40	41	74	52	1.58	.93	4.3
Means	29.25	.60	61.8	72.7	69.5	99	21	79.8	59.2	55	54	80	56	29.79	......	4.8

SAN DIEGO, CAL.

[Lat., 32° 43′ N.; long., 117° 10′ W.]

Jan	30.03	.49	45.1	54.5	51.0	66	35	58.4	43.6	39	44	80	69	2.79	1.32	4.0
Feb	29.97	.42	42.4	58.8	54.3	77	38	62.5	46.1	42	46	78	66	1.70	1.04	4.8
Mar	29.98	.52	51.0	60.5	56.4	74	41	65.1	47.7	42	47	74	64	.41	.38	5.2
Apr	29.94	.30	54.7	60.6	58.6	85	45	64.8	52.3	49	50	81	71	.05	.03	5.9
May	29.90	.30	57.6	63.3	60.4	75	46	65.8	55.1	53	54	81	71	.08	.04	5.8
June	29.87	.26	60.5	68.6	64.1	93	51	70.8	57.4	53	53	78	62	0	0	5.5
July	29.84	.26	65.0	71.5	68.5	80	56	74.4	62.6	61	62	87	71	0	0	3.2
Aug	29.85	.24	66.5	72.4	69.8	89	58	75.4	64.3	61	62	82	70	T.	T.	4.9
Sept	29.82	.29	65.4	71.7	69.1	85	60	75.1	63.1	61	61	86	71	.65	.37	4.2
Oct	29.84	.35	59.0	69.0	64.6	90	49	73.9	55.2	50	56	77	67	.01	.01	2.3
Nov	29.93	.40	56.5	68.0	63.8	91	46	75.8	51.7	36	46	50	50	.72	.72	1.7
Dec	29.96	.43	56.6	65.2	60.8	79	47	69.2	52.3	43	50	64	65	1.61	1.23	4.9
Means	29.91	.36	57.3	65.2	61.8	93	35	69.3	54.3	49	53	77	66	8.02	......	4.2

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

SALT LAKE CITY, UTAH.

[H=4,348. T=90. h=77.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	5.5	32	S.	SE.	4	1	1	20	12	4	1	11	8	9	10	12	13	15	29	0	0	0
Feb	5.8	26	S.	NW.	5	1	4	8	5	4	2	23	4	5	13	10	12	4	18	0	0	0
Mar	5.7	36	NW	NW.	4	3	3	11	6	5	3	22	5	7	11	13	11	2	18	0	0	0
Apr	5.8	35	SE.	NW.	6	5	2	8	6	0	4	20	9	13	11	6	7	0	6	0	1	0
May	5.8	26	SE.	NW.	2	11	4	11	2	2	5	25	0	16	11	4	3	0	0	0	0	0
June	6.2	36	W.	NW.	6	7	1	14	0	3	6	21	2	19	10	1	3	0	0	0	0	0
July	4.8	24	SE.	NW.	2	5	5	20	1	0	1	23	5	24	6	1	1	0	0	18	0	0
Aug	4.4	36	W.	NW.	1	5	7	16	4	3	0	23	3	23	5	3	5	0	0	4	0	0
Sept	3.9	30	SW.	NW.	0	2	11	8	6	1	1	22	9	23	6	1	0	0	0	0	0	0
Oct	3.7	24	SE.	NW.	4	3	5	5	5	2	4	25	9	17	8	6	7	0	2	0	0	0
Nov	2.8	24	W.	NW.	4	8	7	2	2	1	1	20	15	22	4	4	0	0	21	0	0	0
Dec	3.0	25	S.	NW.	5	3	7	5	3	0	5	19	9	14	7	10	5	0	22	0	0	0
Means	4.8	....	.....	NW.	43	54	57	128	52	31	33	254	78	192	102	71	67	21	116	22	1	0

SAN ANTONIO, TEX.

[H=781. T=17. h=1.]

Jan	9.0	28	N.	NE.	7	22	3	21	6	0	0	0	3	4	7	20	16	0	3	0	1	0
Feb	9.8	40	N.	SE.	14	6	4	18	11	1	1	1	0	5	11	12	11	0	1	0	1	0
Mar	10.2	30	N.	NE.	10	19	2	14	14	1	1	1	0	6	13	12	9	0	2	2	2	0
Apr	9.1	34	NE.	SE.	10	13	6	19	9	2	0	0	1	6	12	12	13	0	0	1	5	0
May	7.9	51	N.	SE.	6	5	9	21	14	2	0	2	3	11	12	8	8	0	0	1	2	0
June	9.4	33	N.	SE.	2	7	2	35	11	1	0	1	1	17	9	4	5	0	0	8	0	0
July	6.8	32	N.	SE.	4	2	10	31	7	1	0	0	7	14	14	3	6	0	0	30	1	0
Aug	6.7	29	SE.	SE.	3	6	13	28	8	1	0	0	3	12	7	2	9	0	0	29	2	0
Sept	6.0	29	SW.	SE.	14	12	12	15	2	1	0	1	3	15	9	6	8	0	0	6	3	0
Oct	7.6	30	N.	SE.	16	9	5	18	6	2	0	2	4	21	5	5	8	0	0	4	1	0
Nov	7.6	24	SE.	N.	27	9	3	9	6	0	1	3	2	15	9	6	5	0	0	0	0	0
Dec	7.8	32	N.	N.	17	10	3	14	8	2	2	2	5	16	6	9	7	0	2	0	0	0
Means	8.2	....	.....	SE.	129	120	72	243	102	14	5	13	32	142	124	99	105	0	8	81	18	0

SAN DIEGO, CAL.

[H=93. T=73.4. h=60.0.]

Jan	5.0	28	S.	NE.	11	15	7	2	3	0	12	11	1	15	11	5	9	0	0	0	0	0
Feb	5.2	30	S.	N.	12	8	3	3	4	4	9	11	2	13	3	12	9	0	0	0	0	0
Mar	4.9	24	NW.	NW.	11	14	3	0	2	4	8	20	0	11	9	11	4	0	0	0	0	0
Apr	5.1	20	SE.	W.	11	3	4	2	1	5	18	9	7	9	8	13	2	0	0	0	0	0
May	4.6	21	NW.	W.	3	4	3	2	1	5	27	4	13	12	7	12	3	0	0	0	0	0
June	5.4	21	SW.	SW.	2	0	0	5	6	9	15	9	14	15	15	0	0	0	0	2	0	0
July	4.7	20	SW.	SW.	0	0	0	0	0	18	13	10	21	18	9	4	0	0	0	0	0	0
Aug	4.6	23	NW.	W.	5	0	0	0	0	4	27	12	14	14	7	10	0	0	0	0	0	0
Sept	4.8	24	NW.	NW.	0	1	1	0	2	8	8	25	15	18	1	11	5	0	0	0	0	0
Oct	4.1	21	SW.	NW.	5	1	1	1	3	7	13	12	19	23	3	5	1	0	0	1	0	0
Nov	4.3	21	NE.	NW.	6	6	0	0	1	5	5	21	16	23	5	2	2	0	0	1	0	0
Dec	4.5	26	SE.	W.	4	8	0	2	1	4	9	18	16	14	5	12	6	0	0	0	0	0
Means	4.7	....	.....	W.	70	60	22	17	21	73	164	162	138	185	83	97	41	0	0	4	0	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

SANDUSKY, OHIO.

[Lat., 41° 25′ N.; long., 82° 40′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a.m.	8 p.m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a.m.	8 p.m.	8 a.m.	8 p.m.	Total.	Max. in 24 hours.	
1890.	*In.*	*In.*	°	°	°	°	°	°	°	°	°	%	%	*In.*	*In.*	
Jan	29.48	1.11	35.0	37.4	35.9	69	7	43.5	28.3	29	31	80	78	3.49	1.23	7.7
Feb	29.38	.95	38.1	36.6	35.7	68	12	42.8	28.4	28	29	80	76	3.10	.74	7.4
Mar	29.38	1.30	30.5	33.0	31.9	60	8	37.9	25.9	24	25	78	74	2.78	.98	8.3
Apr	29.44	1.20	45.6	48.5	47.4	84	26	55.4	39.6	36	36	70	66	3.68	1.19	6.4
May	29.26	.75	54.7	57.3	56.7	84	34	64.8	48.6	45	48	72	71	5.28	1.10	7.1
June	29.33	.60	70.9	72.5	72.8	93	54	81.1	64.6	62	62	74	71	2.78	1.12	5.7
July	29.85	.57	70.9	73.8	73.1	98	56	82.2	64.0	58	60	65	62	1.99	.88	4.8
Aug	29.89	.56	66.6	69.2	68.6	96	48	76.4	60.9	56	57	70	67	3.17	1.02	6.2
Sept	29.45	.52	59.2	63.2	62.5	92	43	70.2	54.8	52	54	78	73	4.15	1.70	6.5
Oct	29.27	.98	50.4	52.8	53.6	84	31	60.2	46.9	44	46	81	78	4.66	.79	8.2
Nov	29.88	.83	40.8	44.4	44.1	70	25	51.2	37.0	33	34	75	69	2.56	1.03	6.5
Dec	20.39	6.88	28.3	31.2	30.6	53	12	36.6	24.6	22	24	78	75	.96	.18	8.1
Means	29.38	.85	48.8	51.7	51.1	98	7	58.5	43.6	41	42	75	72	38.6	......	6.9

SAN FRANCISCO, CAL.

[Lat., 37° 48′ N.; long., 122° 26′ W.]

Jan	30.04	.69	43.2	48.0	46.2	59	36	51.1	41.3	38	40	82	74	9.01	2.08	5.9
Feb	30.03	.83	45.5	51.4	49.1	64	36	55.0	43.2	39	41	80	69	5.16	1.63	5.0
Mar	30.04	.71	49.0	55.5	53.8	70	41	60.5	47.0	42	44	79	67	4.73	1.86	5.5
Apr	30.01	.55	49.0	55.8	54.8	81	46	61.6	48.1	45	46	85	71	1.18	.55	5.9
May	29.92	.54	53.1	61.4	59.8	85	47	67.2	52.5	48	49	85	65	1.07	.53	4.7
June	29.95	.37	52.3	60.0	59.2	81	49	66.9	51.6	48	49	86	69	.10	.05	3.9
July	29.91	.38	53.2	61.4	59.8	80	49	67.1	52.4	49	53	88	76	.02	.02	3.3
Aug	29.89	.32	55.1	62.0	61.4	85	50	68.4	54.3	52	54	90	75	.00	.00	4.2
Sept	29.82	.30	55.1	60.1	60.4	81	52	66.8	53.9	52	58	91	78	.31	.31	5.3
Oct	29.88	.52	54.4	62.6	62.4	80	48	71.8	52.9	49	47	82	61	.00	.00	2.7
Nov	29.97	.54	51.9	60.8	59.0	78	46	67.4	50.7	45	44	80	59	.00	.00	2.5
Dec	30.01	.90	46.2	51.0	49.8	60	39	54.8	44.9	43	44	89	78	3.25	1.90	5.2
Means	29.96	.55	50.7	57.5	56.3	86	36	63.2	49.4	46	47	85	70	25.43	......	4.5

SANTA FÉ, N. MEX.

[Lat., 35° 41′ N.; long., 105° 57′ W.]

Jan	23.26	.60	26.6	34.2	32.2	58	2	41.8	22.5	12	13	58	46	.42	.20	5.7
Feb	23.20	.63	30.1	39.6	36.6	67	6	46.7	26.5	12	8	50	36	.38	.30	6.1
Mar	23.24	.60	34.0	47.0	42.0	62	9	52.9	31.0	13	9	47	30	.69	.48	5.7
Apr	23.28	.40	38.9	53.8	47.8	67	17	59.5	36.0	22	13	28	28	2.08	1.27	5.8
May	23.26	.31	51.2	68.2	59.2	80	37	72.1	46.3	26	12	40	14	T.	T.	4.4
June	23.34	.35	57.4	73.4	64.7	86	36	78.7	50.7	29	0	36	14	.13	.07	4.4
July	23.43	.25	62.7	73.2	69.8	90	48	82.0	57.6	47	43	59	39	2.46	.46	6.2
Aug	23.42	.31	59.4	72.6	67.2	88	47	78.9	55.5	46	42	62	36	1.49	.31	5.7
Sept	23.40	.38	51.3	65.2	61.0	82	42	72.5	49.5	36	32	61	36	.80	.30	5.7
Oct	23.33	.51	41.1	53.8	50.0	72	29	61.9	38.0	23	24	52	35	.93	.73	2.5
Nov	23.39	.66	32.6	40.9	39.6	65	18	50.0	29.1	17	23	56	52	1.31	1.01	2.8
Dec	23.34	.65	29.2	34.5	34.6	52	15	43.1	26.0	19	22	70	62	1.00	.61	4.5
Means	23.32	.47	42.9	54.7	50.4	90	2	61.7	39.1	25	21	54	36	12.88	......	5.0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

SANDUSKY, OHIO.

[H=629. T=64. h=54.89.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	11.2	48	SW.	SW.	3	2	1	6	6	22	10	12	0	2	10	19	18	6	19	0	0	0
Feb	11.1	44	NW.	W.	1	5	10	6	5	9	11	9	0	6	5	18	12	5	21	0	2	0
Mar	11.5	42	NW.	NW.	5	6	8	8	5	8	10	16	1	2	7	22	15	7	23	0	2	0
Apr	9.5	36	NW.	E.	5	9	16	4	7	14	1	3	1	5	12	13	10	0	8	0	3	0
May	7.6	32	N.	SW.	4	4	6	10	9	13	5	8	3	5	11	15	17	0	0	0	4	0
June	6.2	34	NE.	E.	4	6	10	9	5	7	9	4	6	8	19	8	15	0	0	2	9	0
July	7.7	34	NW.	SW.	4	9	7	8	3	17	10	4	0	6	23	2	7	0	0	7	5	2
Aug	7.8	40	W.	SE.	6	10	7	11	6	9	9	4	1	4	18	9	10	0	0	2	4	0
Sept	8.4	33	NW.	SW.	5	9	11	6	4	18	2	4	1	9	9	13	10	0	0	1	2	0
Oct	8.2	34	N.	NW.	10	4	3	5	7	9	9	12	3	1	8	22	21	0	2	0	3	0
Nov	9.2	32	SW.	SW.	5	3	4	2	3	18	10	12	3	8	7	15	13	0	7	0	0	0
Dec	10.7	45	NW.	W.	4	5	7	4	5	11	17	6	3	2	10	19	10	10	20	0	0	0
Means	9.1	....	......	SW.	55	72	90	74	65	155	103	94	22	52	130	174	158	28	101	12	34	2

SAN FRANCISCO, CAL.

[H=109. T=109.46. h=101.24.]

Jan	8.0	30	NW.	SE.†	6	3	0	13	15	8	8	0	0	7	10	14	23	0	0	0	4	0
Feb	7.3	36	S.	S.†	7	2	2	5	14	8	0	8	1	10	7	11	12	0	0	0	1	0
Mar	7.5	26	NW.	W.	6	1	1	4	7	6	28	9	0	10	9	12	15	0	0	0	0	0
Apr	9.2	28	W.	W.	1	1	0	0	4	12	38	0	4	6	14	10	6	0	0	0	0	0
May	9.7	36	SW.	SW.	0	0	0	1	2	35	20	3	1	13	14	5	4	0	0	0	0	0
June	12.4	33	SW.	W.	1	0	0	0	1	30	28	0	0	16	13	2	2	0	0	0	0	0
July	11.4	34	W.	SW.	0	0	0	1	1	38	21	0	1	18	13	0	1	0	0	0	0	0
Aug	10.7	36	W.	W.	0	0	1	0	1	22	37	0	1	12	17	2	0	0	0	0	0	0
Sept	7.9	26	W.	W.	0	0	0	0	6	2	51	0	1	6	18	6	2	0	0	0	0	0
Oct	5.7	26	W.	W.	4	3	0	0	2	0	43	2	8	23	8	0	0	0	0	0	0	0
Nov	4.6	26	NW.	N.†	13	3	1	1	1	11	12	8	10	19	11	0	0	0	0	0	0	0
Dec	6.5	36	SW.	N.	20	7	0	4	1	0	9	10	2	9	13	9	6	0	0	0	0	0
Means	8.4	....	......	W.	58	20	5	29	55	181	301	49	29	148	140	71	71	0	0	0	5	0

SANTA FÉ, N. MEX.

[H=7,026. T=35. h=29.]

Jan	6.8	30	N.	NE.	13	17	7	15	3	4	1	2	0	8	14	9	8	5	25	0	0	0
Feb	9.0	36	NE.	N.	15	9	5	1	0	13	6	2	0	7	10	11	7	2	18	0	0	0
Mar	9.2	38	SW.	N.	19	6	6	5	4	9	7	6	0	8	14	9	7	0	14	0	0	0
Apr	7.0	36	NW.	SW.	7	10	14	5	4	12	6	2	0	9	11	10	8	0	6	0	1	0
May	8.2	35	SW.	SW.	3	8	9	13	5	12	3	8	1	17	13	1	0	0	0	0	0	0
June	7.2	36	SW.	SW.	4	11	13	8	2	16	5	1	0	16	13	1	3	0	0	0	0	0
July	6.2	30	NW.	SE.	2	17	17	9	10	3	1	3	0	1	26	4	18	0	0	0	3	0
Aug	5.4	25	NE.	SE.	3	12	16	14	1	12	1	3	0	5	24	2	13	0	0	0	3	0
Sept	5.7	32	NE.	SE.	3	11	14	12	4	5	5	5	1	9	12	9	9	0	0	0	2	0
Oct	7.6	38	NW.	NE.	3	15	0	10	6	10	4	7	1	21	6	4	4	0	8	0	0	0
Nov	6.6	32	S.	NE.	1	32	4	11	4	5	2	1	0	10	6	5	4	0	21	0	1	0
Dec	6.9	40	NE.	NE.	6	37	6	2	4	4	2	1	0	14	11	6	8	0	27	0	0	0
Means	7.2	....	......	NE.	70	185	117	105	53	104	43	11	3	184	100	71	80	7	114	0	10	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

SAULT DE ST. MARIE, MICH.

[Lat., 46° 28′ N.; long., 84° 22′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a. m.	Temperature. 8 p. m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a. m.	Dew-point. 8 p. m.	Relative humidity. 8 a. m.	Relative humidity. 8 p. m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.34	1.43	16.3	19.4	17.6	39	—11	23.9	11.2	14	16	90	88	4.03	.84	9.0
Feb	29.29	1.35	13.4	19.1	16.2	42	—11	23.6	8.9	11	16	90	88	2.91	.44	8.6
Mar	29.30	1.08	12.0	21.1	17.8	44	—27	27.0	8.7	9	15	88	78	1.65	.38	6.5
Apr	29.39	1.02	33.6	37.1	37.0	66	3	46.5	27.5	26	27	76	68	2.64	1.18	6.3
May	29.20	.86	40.9	43.7	43.4	72	24	51.6	35.3	34	34	77	70	3.87	1.05	8.0
June	29.26	.69	59.0	63.0	61.3	86	36	72.4	50.2	52	52	80	70	4.96	2.05	6.4
July	29.26	.65	59.2	63.9	62.8	86	44	72.3	53.3	55	56	86	75	5.16	.98	6.9
Aug	29.33	.64	55.9	59.2	58.6	82	38	67.2	50.3	51	52	84	76	4.11	1.10	7.3
Sept	29.38	.94	49.7	53.5	54.1	79	33	63.3	44.9	46	46	88	76	3.98	1.61	6.7
Oct	29.22	.87	42.2	45.2	45.6	70	29	51.1	40.1	37	38	82	77	2.04	.75	8.4
Nov	29.26	.88	29.5	32.8	31.8	49	15	36.8	26.7	24	26	80	76	2.16	.46	8.6
Dec	29.28	1.30	16.6	21.2	19.0	42	— 7	25.6	12.4	13	16	87	83	2.55	.42	8.7
Means	29.29	.98	35.7	39.9	38.8	86	—27	46.8	30.8	31	33	84	77	40.06	......	7.6

SAVANNAH, GA.

[Lat., 32° 5′ N.; long., 81° 5′ W.]

Jan	30.23	.56	52.9	59.8	59.8	78	32	68.6	51.0	48	52	85	78	.44	.18	5.0
Feb	30.07	.50	54.5	60.7	61.2	80	38	70.3	52.1	50	53	86	77	1.02	.41	4.1
Mar	30.06	.57	51.4	57.0	56.6	81	26	66.0	47.3	45	46	81	70	2.75	1.65	5.1
Apr	30.08	.72	62.2	65.8	66.5	88	46	75.1	57.9	54	55	75	70	1.09	.96	4.7
May	29.93	.49	70.4	71.8	73.0	89	51	81.0	64.9	62	63	76	75	3.13	.88	5.3
June	29.98	.47	78.1	79.1	80.9	98	65	90.3	71.5	71	72	78	79	4.38	1.24	4.8
July	29.98	.52	77.1	77.9	79.5	94	67	87.1	71.9	71	71	82	80	7.72	2.22	6.0
Aug	30.01	.37	75.8	77.1	78.6	94	63	86.4	70.7	69	70	81	78	2.80	1.17	4.4
Sept	29.99	.34	72.7	73.9	75.4	88	53	82.2	68.6	69	70	88	88	10.58	4.85	6.9
Oct	29.94	.54	62.4	66.8	67.0	89	41	75.4	58.5	57	58	84	75	4.12	3.79	3.6
Nov	30.08	.46	54.5	61.8	61.5	79	36	70.6	52.4	50	53	85	76	.51	.46	3.8
Dec	30.08	.66	45.6	52.2	51.8	77	31	60.9	42.7	39	41	79	68	2.92	1.33	3.7
Means	30.04	.52	63.1	67.0	67.6	98	26	76.2	59.1	57	59	82	76	47.46	......	[illegible].8

SHREVEPORT, LA.

[Lat., 32° 30′ N.; long., 93° 43′ 40″ W.]

Jan	29.94	.83	52.9	50.1	56.6	78	26	64.4	48.8	48	51	85	76	5.15	2.62	6.6
Feb	29.79	.77	52.1	59.7	57.4	80	22	66.4	48.5	48	47	86	66	4.63	1.40	5.3
Mar	29.80	.98	50.9	60.3	57.0	87	22	65.6	48.3	46	48	84	66	3.60	1.37	6.5
Apr	29.80	.46	60.4	69.6	66.5	86	47	74.9	58.1	55	57	84	66	3.22	1.50	6.4
May	29.67	.50	67.2	76.8	73.2	92	53	82.9	63.6	61	62	82	62	1.95	.51	4.6
June	29.76	.32	73.5	81.3	79.5	97	61	88.6	70.4	70	70	89	70	3.12	2.10	5.5
July	29.75	.38	76.5	84.9	83.0	99	68	92.7	73.2	72	73	87	68	2.09	.89	5.0
Aug	29.77	.31	73.3	82.9	80.6	96	65	91.1	70.2	70	69	88	64	.62	.24	5.4
Sept	29.76	.33	68.0	74.7	73.8	92	48	82.5	65.2	66	66	91	77	7.23	2.26	6.3
Oct	29.77	.57	57.3	66.8	64.6	88	40	74.6	54.7	54	56	88	69	3.53	1.40	4.2
Nov	29.89	.49	50.6	61.0	58.1	80	34	68.1	48.1	47	49	88	67	3.07	1.37	4.2
Dec	29.92	.91	46.0	55.3	52.2	76	27	61.6	42.7	41	43	82	67	2.33	.94	5.8
Means	29.80	.57	60.7	69.4	66.9	99	22	76.1	57.6	56	58	86	68	40.54	......	5.5

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

SAULT DE ST. MARIE, MICH.

[H=642. T=56. h=48.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890																						
Jan	7.5	25	NW.	SE.	2	3	6	27	1	0	3	18	2	0	4	27	25	23	31	0	0	0
Feb	8.0	30	NW.	SE.	4	6	8	16	3	3	3	10	3	0	8	20	18	21	28	0	0	1
Mar	8.0	36	NW.	NW.	6	4	4	15	3	1	4	20	5	7	9	15	15	18	29	0	0	0
Apr	7.8	48	NW.	SE.	6	6	6	18	5	2	6	11	0	5	12	13	13	1	20	0	0	0
May	8.6	36	NW.	NW.	3	4	2	17	4	1	4	27	0	1	7	23	20	0	11	0	1	0
June	7.6	34	NW.	NW.	0	1	5	20	5	1	2	23	3	3	13	14	14	0	0	0	0	0
July	6.8	28	SE.	NW.	3	1	5	16	5	2	6	23	1	7	6	18	15	0	0	0	8	0
Aug	7.3	26	NW.	SE.	10	0	1	22	4	3	3	18	1	5	6	20	17	0	0	0	6	3
Sept	6.9	28	NW.	SE.	4	2	1	24	7	0	7	11	4	7	6	17	16	0	0	0	2	0
Oct	7.4	46	SE.	SE.	6	10	4	17	2	3	3	15	2	0	8	23	15	0	3	0	0	2
Nov	9.4	40	NW.	SE.	6	5	3	19	5	1	7	13	1	0	4	26	18	6	24	0	0	0
Dec	10.0	50	NW.	SE.	7	4	6	18	2	4	8	13	0	1	3	27	21	20	21	0	0	0
Means	7.9	....	......	SE.	57	46	51	229	46	21	56	202	22	36	86	243	207	89	177	0	17	6

SAVANNAH, GA.

[H=87. T=66. h=56.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	7.1	32	NE.	NE.	6	11	4	4	7	9	10	7	4	11	11	9	10	0	0	0	0	0
Feb	7.5	27	NE.	SW.	5	6	2	3	9	12	5	6	8	16	6	6	7	0	0	0	1	0
Mar	8.6	34	NW.	NW.	4	3	3	3	12	11	3	19	4	10	12	9	13	0	5	0	2	0
Apr	8.3	28	NE.	S.	9	12	3	10	13	9	5	7	1	15	7	8	3	0	0	0	1	0
May	7.3	35	SW.	SW.	7	3	4	6	16	14	4	5	3	11	10	10	12	0	0	0	8	0
June	6.2	35	NW.	SW.	0	2	2	4	15	18	11	2	6	8	20	2	10	0	0	17	10	0
July	5.6	25	NE.	S.	1	7	4	7	20	9	6	4	4	6	14	11	16	0	0	6	6	0
Aug	5.3	22	SW.	S.	3	8	4	9	20	11	4	2	1	12	16	3	12	0	0	5	2	0
Sept	4.9	28	NE.	NE.	6	14	8	7	7	6	8	2	7	4	12	14	22	0	0	0	3	0
Oct	6.3	30	NW.	SW.	4	10	3	3	6	13	8	13	2	19	6	6	7	0	0	0	0	0
Nov	4.8	21	NW.	SE.	3	8	4	15	6	6	5	7	6	15	11	4	3	0	0	0	0	0
Dec	7.3	38	W.	W.	6	7	6	4	3	3	21	10	2	18	6	7	8	0	1	0	0	0
Means	6.6	....	......	S.	45	91	47	75	134	121	85	84	48	145	131	89	123	0	6	28	33	0

SHREVEPORT, LA.

[H=249. T=77.4. h=75.8.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	8.2	38	S.	S.	6	9	6	9	17	4	3	7	1	3	13	15	13	0	3	0	5	0
Feb	8.0	38	NW.	S.	4	5	5	10	17	2	4	6	3	8	9	11	10	0	1	0	5	0
Mar	9.3	35	NW.	S.	3	8	7	15	16	1	1	7	4	5	11	15	13	0	3	0	2	0
Apr	7.9	30	SE.	SE.	3	2	4	16	12	5	5	10	3	6	10	14	11	0	0	0	2	0
May	6.8	34	N.	SE.	4	5	6	19	17	1	1	6	3	7	17	7	9	0	0	1	3	0
June	5.4	24	NE.	SW.	4	2	3	9	14	21	3	1	3	7	13	10	6	0	0	15	5	0
July	4.5	24	NE.	S.	7	5	7	10	16	7	7	2	2	10	15	6	7	0	0	26	7	0
Aug	5.1	38	SW.	SE.	4	3	7	21	15	6	2	1	0	9	13	9	5	0	0	23	4	0
Sept	4.7	30	E.	S.	6	7	8	11	12	1	3	8	4	8	7	15	13	0	0	5	5	0
Oct	5.3	34	NW.	S.	7	3	6	11	11	4	8	7	5	16	8	7	8	0	0	0	0	0
Nov	5.9	23	NW.	NW.	7	7	3	10	8	0	10	12	3	17	5	8	5	0	0	0	0	0
Dec	7.2	30	NW.	SE.	6	2	2	16	13	0	10	12	1	10	8	13	8	0	2	0	0	0
Means	6.5	....	......	S.	61	58	64	160	107	52	57	79	32	106	129	130	108	0	9	70	38	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

SIOUX CITY, IOWA.

[Lat., 42° 29′ N.; long., 96° 24′.]

Months and year.	Pressure (actual).		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.)	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	28.43	1.19	10.7	16.3	14.0	52	−20	22.9	5.2	6	10	81	77	1.14	.51	5.5
Feb	28.83	1.13	15.7	25.8	22.9	62	−18	32.4	13.4	7	14	70	73	.40	.18	5.5
Mar	28.83	1.18	22.7	31.7	28.4	58	− 7	36.6	20.1	16	20	74	63	2.12	1.58	5.6
Apr	28.78	1.08	43.3	57.8	52.1	88	13	64.3	39.9	35	32	73	44	1.32	.90	4.8
May	28.62	.68	50.6	63.9	57.8	88	30	69.9	45.7	40	40	68	46	2.29	.64	5.4
June	28.67	.80	66.7	76.6	72.4	96	50	82.5	62.4	59	61	78	61	3.61	1.14	5.0
July	28.74	.54	69.4	81.2	76.0	104	50	87.0	64.9	61	62	75	54	2.59	1.72	4.3
Aug	28.80	.58	61.4	73.7	69.0	93	43	80.5	57.4	54	55	77	55	3.04	1.69	5.4
Sept	28.83	.80	52.5	64.7	61.8	89	34	74.0	49.6	46	48	80	55	2.36	.82	4.4
Oct	28.72	.88	41.5	52.8	50.2	73	24	60.9	39.6	36	36	80	55	1.84	1.62	5.8
Nov	28.87	.98	31.1	41.8	40.4	74	15	51.5	29.3	25	29	79	62	.84	.50	3.2
Dec	28.86	.92	23.4	32.7	31.5	68	− 3	41.8	21.2	16	17	76	56	.10	.05	3.9
Means	28.79	.90	40.8	51.6	48.0	104	-20	58.7	37.4	33	35	70	58	22.25		4.9

SPOKANE FALLS, WASH.

[Lat. 47° 40′ N.; long., 117° 25′ W.]

Jan	27.92	1.08	16.8	21.2	17.9	46	−23	24.2	11.0	13	16	89	88	3.19	.74	9.2
Feb	27.91	1.38	20.6	28.8	24.4	52	−23	33.2	15.6	17	20	87	73	3.15	.62	6 4
Mar	27.94	1.19	32.5	42.9	37.6	57	12	45.3	30.0	28	28	83	58	2.34	.41	8.3
Apr	27.94	0.76	30.0	58.6	48.7	86	22	61.3	36.1	32	26	76	31	.38	.24	6.4
May	27.91	.79	48.5	67.0	58.1	88	38	70.2	46.0	38	31	70	35	1.58	.90	5.9
June	27.95	.65	51.2	69.0	60.5	93	41	71.4	49.6	43	37	75	34	1.98	.71	6.7
July	27.94	.38	56.1	79.8	68.4	102	45	82.4	54.3	42	30	62	24	.38	.27	3.0
Aug	27.94	.45	54.9	80.7	68.6	93	48	83.1	54.1	42	35	63	22	.38	.36	2.9
Sept	27.99	.61	46.2	72.3	60.0	87	33	75.1	44.8	38	32	74	25	.88	.50	3.5
Oct	28.02	.65	40.2	53.0	47.8	65	29	57.0	38.5	33	32	70	48	1.02	.38	6.8
Nov	28.18	.61	31.0	42.2	38.4	60	23	47 3	29.4	27	28	87	60	.06	.02	5.3
Dec	28.01	1.10	34.5	39.7	38.2	54	25	44.8	31.5	28	30	79	70	1.23	.35	7.4
Means	27.97	.81	39.2	54.6	47.4	102	−23	57.9	36.8	32	30	77	47	16.57	......	6.0

SPRINGFIELD, ILL.

[Lat. 39° 48′ N.; long., 89° 39′ W.]

Jan	29.49	1.23	20.2	36.3	33.3	68	− 2	41.0	25.0	25	30	85	78	5.72	1.62	5.8
Feb	29.39	.95	30.7	37.2	35.8	71	4	43.5	28.2	26	30	82	74	2.01	.53	6.9
Mar	29.40	1.35	28.6	37.3	34.2	64	2	42.6	25.9	23	24	80	62	2.20	.98	5.6
Apr	29.38	1.04	47.7	58.0	54.0	85	26	61.2	43.8	40	44	76	61	2.94	1.76	5.1
May	29.25	.65	55.1	63.4	60.0	89	35	70.4	49.7	47	51	76	66	4.33	2.15	4.7
June	29.30	.55	71.6	79.4	76.0	97	50	86.3	65.6	65	66	79	66	4.50	2.10	5.0
July	29.33	.38	70.3	79.4	75.9	100	51	87.1	64.7	60	62	71	58	2.14	1.12	3.5
Aug	29.37	.49	65.2	74.8	71.0	97	48	81.2	60.7	58	58	78	58	1.03	.54	4.[illegible]
Sept	29.41	.57	55.8	65.9	62.7	91	36	73.2	52.2	51	53	83	63	.96	.70	5.6
Oct	29.20	.75	47.6	56.0	54.4	88	23	63.5	45.4	43	44	84	64	1.30	.37	5.4
Nov	29.42	.71	38.1	46.6	45.2	74	26	51.3	36.0	32	34	78	64	1.29	.68	4.3
Dec	29.43	.80	27.9	35.7	34.0	60	14	42.2	25.7	21	22	75	60	.26	.15	4.4
Means	29.37	.80	47.3	55.8	53.0	100	− 2	62.5	43.6	41	43	79	64	28.68	......	5.1

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

SIOUX CITY, IOWA.

[H=1,158. T=88.7. h=78.3.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	8.6	36	S.	NW.	11	3	4	7	12	2	2	15	6	10	10	11	7	20	30	0	0	0
Feb	11.2	36	S.	N.	18	1	2	4	14	1	0	14	2	9	8	11	6	15	26	0	0	0
Mar	10.5	42	SE.	NW.	9	6	6	3	13	0	0	16	9	8	12	11	12	9	25	0	0	0
Apr	10.8	40	S.	S.	10	5	11	7	13	1	1	8	4	12	8	10	9	0	8	0	1	0
May	11.5	43	S.	S.	11	5	4	2	19	3	0	13	5	8	14	9	12	0	2	0	7	0
June	9.5	38	SE.	S.	8	3	7	3	22	3	2	6	6	10	13	7	12	0	0	6	8	0
July	9.5	42	S.	S.	5	11	5	8	21	1	0	6	5	16	10	5	7	0	0	11	6	0
Aug	8.0	36	SE.	S.	7	5	4	8	20	0	0	5	13	1	10	10	12	0	0	8	9	0
Sept	8.3	38	S.	S.	5	3	6	8	17	0	1	7	13	1	11	8	7	0	0	0	6	0
Oct	8.7	40	N.	S.	9	4	5	8	12	1	1	12	10	7	14	10	9	0	4	0	1	0
Nov	6.7	26	N.	NW.	12	1	1	3	15	1	1	16	10	18	7	5	4	1	18	0	0	0
Dec	7.7	40	NW.	NW.	1	2	8	8	18	0	1	19	15	15	9	7	3	9	28	0	0	0
Means	9.2	....	......	S	106	49	58	69	191	13	9	137	98	135	126	104	100	54	136	20	32	0

SPOKANE FALLS, WASH.

[H=1,938. T=100. h=92.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	4.5	24	SW.	SW.	0	11	8	2	4	18	1	5	13	1	2	28	26	22	28	0	0	0
Feb	4.6	36	SW.	SW†	0	3	7	0	6	16	4	3	17	0	9	13	13	13	26	0	0	0
Mar	4.3	26	SW.	SW†	1	7	2	0	4	18	3	2	25	1	7	23	12	1	17	0	0	0
Apr	4.4	36	SW.	SW.	0	2	8	1	7	18	8	2	14	3	18	9	4	0	9	0	0	0
May	5.8	26	SW.	SW†	0	7	3	1	4	16	12	1	18	10	7	14	9	0	0	0	0	0
June	4.8	24	S.	SW.	1	5	3	3	8	25	7	2	6	8	16	11	13	0	0	3	1	0
July	4.5	24	SW.	SW.	1	2	3	1	8	19	8	6	14	10	9	3	5	0	0	7	0	0
Aug	3.9	24	S.	S†	0	4	1	3	10	9	7	5	23	20	9	2	3	0	0	4	1	0
Sept	1.3	24	SW.	SW†	0	4	3	2	0	9	0	3	39	18	6	6	5	0	0	0	1	0
Oct	4.0	24	SW.	SW.	0	6	6	1	6	22	3	4	12	6	10	15	11	0	5	0	0	0
Nov	2.8	24	SW.	NE.	2	11	9	6	3	10	2	7	10	8	15	7	3	0	22	0	0	0
Dec	5.1	48	SW.	SW.	2	11	3	12	3	15	5	3	8	3	12	16	13	0	15	0	0	0
Means	4.1	....	......	SW†	7	73	58	32	63	195	60	43	190	98	120	147	117	36	122	14	3	0

SPRINGFIELD, ILL.

[H=644. T=80. h=64.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	11.0	44	SW.	S.	5	3	4	2	17	7	7	15	2	8	8	15	15	8	20	0	0	0
Feb	10.1	36	NW.	NW.	7	3	4	4	15	5	2	16	0	7	4	17	10	6	18	0	1	0
Mar	9.8	36	E.	NW.	5	7	2	7	11	6	4	20	0	8	11	12	13	7	19	0	1	0
Apr	9.5	48	S.	S.	4	12	5	3	14	6	3	4	9	10	9	11	10	0	3	0	4	0
May	7.5	41	E.	S.	6	7	2	2	18	8	4	5	10	11	14	6	11	0	0	0	6	0
June	5.7	28	N.	SW.	2	3	4	7	4	17	5	3	15	8	17	5	9	0	0	10	10	0
July	5.6	36	E.	S.	3	6	6	7	13	8	3	9	7	17	11	3	8	0	0	9	9	0
Aug	6.6	24	NW.	NW.	9	7	7	8	7	9	3	9	8	16	6	9	6	0	0	4	4	0
Sept	8.3	32	NW.	NE.	9	20	1	5	14	7	1	2	1	8	14	8	8	0	0	1	3	0
Oct	9.4	48	W.	NW.	6	3	4	0	9	14	8	18	0	9	13	9	8	0	2	0	2	0
Nov	9.1	26	S.	NW.	7	6	1	3	6	10	12	14	1	14	8	8	6	0	9	0	0	0
Dec	10.7	34	W.	NW.	4	9	3	3	12	9	3	19	0	13	11	7	8	7	25	0	0	0
Means	8.6	....	......	S.	67	86	43	51	140	106	55	134	48	129	126	110	107	28	96	24	40	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

SPRINGFIELD, MO.

[Lat., 37° 12′ N.; long., 93° 18′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a.m.	8 p.m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a.m.	8 p.m.	8 a.m.	8 p.m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	28.72	.92	34.4	40.4	39.4	74	4	49.2	29.4	31	34	87	79	5.51	1.95	6.6
Feb	28.61	.91	34.6	40.1	40.2	76	—2	49.5	30.9	30	34	86	79	5.22	1.86	7.0
Mar	28.61	1.14	34.6	44.1	42.6	75	6	53.6	31.7	27	32	77	64	4.23	2.85	5.8
Apr	28.61	.65	50.9	60.5	58.2	88	32	67.5	48.8	43	44	77	60	3.57	1.00	5.9
May	28.51	.47	58.0	65.9	64.6	88	36	75.4	53.7	51	52	78	63	3.81	.85	5.0
June	28.59	.48	71.1	78.7	75.6	96	54	86.1	65.1	64	64	78	62	1.33	.78	4.1
July	28.62	.30	72.3	80.4	78.2	95	59	88.4	68.1	65	67	77	64	4.25	1.66	3.9
Aug	28.64	.37	67.5	74.7	73.6	94	56	87.6	64.6	63	66	86	75	8.21	2.36	5.2
Sept	28.65	.45	57.9	64.0	63.4	87	38	71.0	55.7	55	58	91	82	8.11	2.72	6.3
Oct	28.59	.67	48.6	57.7	56.3	84	29	65.4	47.2	44	46	85	66	3.97	1.61	4.5
Nov	28.70	.67	40.5	50.4	48.2	78	29	57.6	38.7	34	37	79	62	2.41	1.11	4.2
Dec	28.70	.95	33.6	41.2	40.0	64	11	48.3	31.7	28	28	80	63	1.95	.99	4.3
Means	28.63	.66	50.3	58.2	56.7	96	—2	66.6	47.1	45	47	82	68	52.57	......	5.2

TAMPA, FLA.

[Lat., 27° 57′ N.; long., 82° 27′ W.]

Jan	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Feb	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Mar[1]	30.08	.39	63.6	66.9	......	88	......	78.6	......	58	59	81	78	.96	.73	5.4
Apr	30.13	.46	70.2	70.5	[2] 72.0	90	52	83.4	[2] 60.7	62	60	75	70	.55	.43	3.8
May	29.98	.48	74.0	75.5	75.5	90	58	85.7	67.3	67	67	79	76	4.49	1.40	6.2
June	30.07	.30	80.3	79.1	80.8	94	65	89.4	72.1	73	73	79	81	11.58	2.16	6.2
July	30.04	.37	79.1	79.0	80.2	92	65	88.1	72.4	74	73	84	83	11.91	1.42	5.9
Aug	30.05	.30	78.7	78.0	80.6	93	67	89.1	72.0	73	73	83	84	8.87	1.96	5.5
Sept	30.01	.26	77.2	77.1	79.5	92	66	88.2	70.8	72	73	84	88	9.24	1.13	6.7
Oct	30.00	.25	71.6	72.7	74.2	90	46	82.4	66.1	67	66	85	81	5.05	2.03	4.7
Nov	30.09	.38	63.5	68.6	69.2	86	43	78.6	59.8	58	61	84	78	3.31	2.50	5.1
Dec	30.17	.38	55.1	59.4	60.6	81	31	69.8	51.5	50	52	83	77	1.32	.50	8.8
Means	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

[1] 12th, 8 p. m. observation not taken; 13th, 8 a. m. observation not taken. [2] For 29 days only.

TITUSVILLE, FLA.

[Lat., 28° 34′ N.; long., 80° 51′ W.]

Jan	30.26	.26	61.8	67.3	66.4	82	48	74.7	58.0	59	63	90	86	.34	.18	4.0
Feb	30.12	.38	61.7	68.0	66.6	87	48	75.1	58.2	59	63	93	86	.83	.48	3.9
Mar	30.12	.46	60.1	63.8	62.8	88	32	72.1	53.5	54	59	82	86	3.84	2.52	4.4
Apr	30.14	.49	69.1	71.2	70.1	89	54	78.7	61.5	63	64	82	78	.76	.26	3.6
May	29.99	.49	74.3	74.1	74.8	91	56	82.1	67.6	69	70	84	86	15.14	3.84	6.2
June	30.06	.35	79.3	77.4	79.5	95	66	86.9	72.1	74	72	84	85	6.26	1.06	5.0
July	30.04	.43	79.8	78.5	80.0	92	69	86.2	73.9	75	73	85	85	7.49	1.96	5.8
Aug	30.05	.32	80.0	79.7	80.2	94	70	86.3	74.1	74	74	84	84	3.74	.82	5.2
Sept	30.02	.29	77.8	78.4	78.8	88	67	85.3	72.3	74	73	88	85	8.54	1.28	5.8
Oct	29.99	.25	71.7	73.7	74.2	90	47	81.6	66.8	66	67	84	81	2.21	.62	4.1
Nov	30.08	.41	66.1	68.4	69.0	83	49	75.8	62.3	61	64	86	85	3.26	1.50	4.3
Dec	30.14	.40	55.0	59.5	60.4	82	38	68.3	52.5	50	55	84	85	.92	.64	3.2
Means	30.08	.38	69.7	71.7	71.9	95	32	79.4	64.4	65	66	86	84	53.33	......	4.6

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

SPRINGFIELD, MO.

[H=1,356. T=772½. h=744½.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	11.5	54	W.	S.	7	7	1	12	18	5	3	7	2	6	11	14	13	6	19	0	1	0
Feb	11.1	36	W.	SE.	10	8	6	11	6	7	0	6	2	6	4	18	13	2	13	0	2	0
Mar	12.7	60	NW.	N.	11	11	9	10	8	7	2	4	0	7	14	10	8	0	14	0	3	0
Apr	11.7	40	SW.	E.	6	5	12	11	9	8	4	5	0	10	7	13	11	0	0	0	3	0
May	9.4	40	SW.	SE.	6	1	4	17	11	6	6	8	3	11	9	11	16	0	0	0	8	0
June	8.4	42	NW.	S.	3	3	3	6	22	17	1	5	0	12	16	2	7	0	0	8	8	0
July	7.2	30	S.	S.	9	3	7	15	16	10	1	1	0	12	18	1	8	0	0	12	10	0
Aug	7.0	36	SW.	SE.	7	6	7	20	10	5	2	3	2	7	18	6	13	0	0	5	10	0
Sept	8.2	48	NW.	NE.	8	22	0	20	4	0	0	4	2	6	11	13	15	0	0	0	6	0
Oct	9.3	36	SW.	SE.	5	5	1	16	11	7	7	9	1	12	10	9	11	0	1	0	3	0
Nov	8.2	30	N.	S.	11	5	4	7	14	4	5	7	3	12	11	7	9	0	5	0	2	0
Dec	9.7	38	NW.	N.	13	4	5	11	9	10	3	5	2	13	9	9	5	3	14	0	1	0
Means	9.5	....	......	SE.	96	80	59	156	138	80	34	64	17	114	138	113	120	11	66	25	57	0

TAMPA, FLA.

[H=36. T=45. h=36.

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Feb	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Mar[1]	5.5	22	SW.	SW.	6	1	3	2	5	8	3	4	5	6	10	3	5	0	0	0	0	0
Apr	5.9	28	NE.	W.	8	7	5	9	1	5	9	8	8	18	8	4	4	0	0	0	0	0
May	5.4	29	E.	NE.	3	14	7	7	4	10	9	5	3	5	12	14	15	0	0	2	0	0
June	3.4	24	E.	E.	3	7	11	9	1	9	8	2	10	3	17	10	16	0	0	10	6	0
July	5.1	25	SE.	E.	4	4	22	12	4	9	4	1	2	9	8	14	20	0	0	4	6	0
Aug	4.2	23	E.	E.	4	19	20	9	2	3	4	1	3	6	18	7	19	0	0	10	5	0
Sept	3.5	24	E.	E.	0	17	25	2	1	5	4	0	6	1	16	13	27	0	0	8	4	0
Oct	4.4	24	NW.	NE.	3	16	7	3	5	0	8	13	7	13	13	5	11	0	0	1	1	0
Nov	5.0	24	NE.	NE.	7	22	11	0	0	1	5	14	0	9	14	7	6	0	0	0	0	0
Dec	5.2	30	W.	W.	11	9	2	3	5	5	12	10	5	17	11	3	5	0	1	0	0	0
Means	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

[1] For 29 days only.

TITUSVILLE, FLA.

[H=44. T=16. h=15.]

Months and year.	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	10.4	46	E.	SE.	12	6	12	14	2	3	7	2	4	20	7	4	5	0	0	0	0	0
Feb	8.6	48	N.	S.	7	1	1	10	13	7	4	7	6	19	5	4	5	0	0	0	0	0
Mar	12.0	30	N.	S.	9	3	2	13	16	2	5	12	0	17	9	5	8	0	0	0	0	0
Apr	12.2	37	NE.	SE.	2	3	15	16	3	8	10	3	0	21	7	2	8	0	0	0	0	0
May	10.9	38	SE.	S.	3	7	10	11	13	10	6	1	1	9	8	14	20	0	0	2	4	0
June	9.1	45	S.	SE.	1	1	3	16	6	16	14	3	0	13	10	7	18	0	0	5	0	0
July	8.9	35	NE.	SW.	0	5	13	13	5	16	8	2	0	10	10	11	21	0	0	2	1	0
Aug	9.2	32	NE.	SE.	1	9	10	23	6	8	1	4	0	12	12	7	17	0	0	2	0	0
Sept	6.0	38	SE.	SE.	3	8	6	20	5	7	3	7	1	8	12	10	22	0	0	0	1	0
Oct	8.7	35	W.	NW.	5	9	5	4	7	8	8	15	1	18	7	6	10	0	0	1	0	0
Nov	10.9	52	NE.	E.	3	10	17	6	0	1	6	16	1	14	11	5	12	0	0	0	0	0
Dec	10.3	36	W.	NW.	7	4	1	5	1	6	13	25	0	22	5	4	6	0	0	0	0	0
Means	9.8	....	......	SE.	53	66	95	151	77	92	85	97	14	183	103	79	152	0	0	12	6	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

TOLEDO, OHIO.

[Lat., 41° 40′ N.; long., 83° 34′ W.]

Months and year.	Pressure (actual). Mean.	Pressure (actual). Absolute range.	Temperature. 8 a.m.	Temperature. 8 p.m.	Temperature. Mean (max. and min.).	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean. Maximum.	Temperature. Mean. Minimum.	Dew-point. 8 a.m.	Dew-point. 8 p.m.	Relative humidity. 8 a.m.	Relative humidity. 8 p.m.	Precipitation. Total.	Precipitation. Max. in 24 hours.	Mean cloudiness (in tenths).
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	29.43	1.11	32.2	36.4	36.1	71	5	45.0	27.2	28	30	84	78	3.30	1.37	6.4
Feb	29.34	.92	31.4	36.0	35.8	67	13	44.0	27.5	27	28	84	73	2.90	.91	6.4
Mar	29.35	1.26	28.9	33.8	32.5	60	6	39.7	25.3	23	23	78	66	1.56	.34	6.4
Apr	29.40	1.18	44.6	50.0	48.2	75	26	57.5	39.0	36	36	72	60	4.05	1.50	4.7
May	29.83	.77	62.5	58.5	56.2	86	35	61.8	47.6	44	45	75	64	4.04	1.50	6.0
June	29.29	.58	70.1	74.5	72.8	94	46	82.3	63.4	61	60	74	62	2.49	.94	5.3
July	29.31	.58	69.1	75.5	72.6	95	50	82.4	62.9	58	57	69	51	.86	.57	4.1
Aug	29.35	.56	63.3	69.9	67.8	96	45	76.7	58.9	55	55	76	61	4.43	2.11	4.7
Sept	29.42	.58	56.7	61.4	61.0	87	38	68.9	53.1	50	52	80	72	2.68	1.68	5.7
Oct	29.24	.95	48.0	52.2	52.6	80	21	59.5	45.7	44	44	86	75	3.93	1.24	7.8
Nov	29.36	.70	39.2	43.6	73.2	68	25	50.4	35.9	33	33	80	67	2.27	.97	5.3
Dec	29.37	.89	26.7	30.3	29.7	51	13	36.5	22.9	22	22	84	71	1.04	.31	6.4
Means .	29.34	.84	46.9	57.9	50.7	96	5	59.0	42.4	40	40	78	67	33.64	......	5.8

VALENTINE, NEBR.

[Lat., 42° 50′ N.; long., 100° 32′ W.]

Jan	27.34	1.03	6.2	13.8	11.0	59	—24	21.4	.7	—1	4	72	67	.60	.32	6.2
Feb	27.29	1.02	16.3	25.3	23.0	66	—22	33.9	12.1	6	13	64	62	1.40	.00	5.9
Mar	37.28	.95	22.8	36.8	32.2	69	— 3	42.2	22.3	18	24	74	61	2.28	.64	5.9
Apr	27.31	.91	40.9	57.6	50.0	83	17	63.3	36.6	32	33	72	44	1.33	.50	4.0
May	27.20	.73	48.0	62.6	55.2	91	26	68.0	42.3	37	38	68	42	1.91	.97	5.1
June	27.22	.71	61.9	74.9	68.8	98	44	80.6	56.9	54	51	76	47	3.09	.85	4.4
July	27.29	.61	66.1	83.1	75.6	103	54	88.0	62.2	58	56	76	44	4.39	2.52	3.4
Aug	27.32	.55	59.7	76.0	69.3	98	44	82.2	56.4	53	54	80	40	2.01	.46	4.1
Sept	27.34	.75	49.0	67.8	61.9	92	27	76.6	47.2	43	44	82	45	.68	.58	4.8
Oct	27.27	.72	38.2	53.8	48.7	80	19	62.5	34.9	32	35	80	52	.64	.38	5.5
Nov	27.42	.96	27.2	42.0	38.4	75	1	52.9	23.9	22	27	82	59	.93	.80	4.1
Dec	27.34	.90	23.4	34.3	32.2	68	1	45.3	19.2	18	22	80	63	.32	.22	4.9
Means .	27.30	.82	38.6	52.3	47.9	103	—24	50.8	34.6	31	33	76	53	19.79	......	4.9

VICKSBURG, MISS.

[Lat., 32° 22′ N.; long., 90° 53′ W.]

Jan	29.99	.68	53.9	61.1	59.2	82	28	67.4	51.0	50	50	86	68	5.31	2.53	5.7
Feb	29.83	.80	54.7	61.2	60.0	70	32	68.5	51.5	40	47	81	62	4.59	1.63	5.0
Mar	29.85	.84	50.9	59.6	56.8	81	24	64.9	48.7	42	43	74	57	5.01	2.73	5.5
Apr	29.85	.40	62.1	60.2	67.2	83	51	75.5	59.0	55	55	78	62	6.32	1.90	5.4
May	29.72	.55	67.6	74.0	71.7	88	50	80.7	62.7	61	60	80	65	7.58	3.25	4.2
June	29.81	.20	75.2	79.2	79.9	94	66	88.7	71.1	71	70	85	76	5.51	1.30	5.5
July	29.78	.37	76.8	82.0	82.6	99	68	91.6	73.5	71	72	83	72	3.56	1.12	5.6
Aug	29.81	.46	73.8	80.3	80.0	93	65	88.9	71.2	69	71	84	73	5.41	2.19	5.0
Sept	29.79	.31	68.9	74.4	74.9	91	53	82.9	66.9	66	68	80	81	2.28	.54	6.2
Oct	29.80	.58	58.1	65.9	64.8	88	38	74.2	55.4	51	56	87	73	2.87	1.30	2.6
Nov	29.91	.41	51.8	62.9	60.4	83	35	70.6	50.2	48	52	87	68	1.57	.60	8.9
Dec	29.94	.78	45.9	55.3	52.4	79	27	61.7	43.1	40	42	82	62	2.22	1.53	4.8
Means .	29.84	.54	61.6	68.8	67.5	99	24	76.3	58.7	56	57	83	68	52.23	......	5.

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

TOLEDO, OHIO.

[H=674. T=122. h=113.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunder storms.	Auroras.
1890.																						
Jan	11.2	50	S.	SW.	1	0	2	8	8	18	12	9	4	6	11	14	17	6	18	0	0	0
Feb	9.8	40	N.	SW.	1	9	6	4	4	14	7	9	2	6	9	13	14	2	20	0	0	0
Mar	11.6	48	SW.	NW.	0	8	1	9	3	9	13	19	0	4	15	12	13	7	24	0	2	0
Apr	11.3	47	SW.	NE.	3	15	8	8	5	13	2	6	0	11	12	7	11	0	5	0	3	0
May	6.9	80	NE.	SW.	2	11	1	9	2	16	6	8	7	8	12	11	16	0	0	0	4	0
June	5.6	86	N.	SW.	0	7	3	9	2	12	8	8	16	7	18	5	9	0	0	3	5	0
July	7.0	36	W.	SW.	2	6	4	8	2	18	3	8	11	13	16	2	6	0	0	6	4	0
Aug	6.6	32	NW	NW.	2	9	6	10	2	11	3	14	5	12	10	9	5	0	0	3	4	0
Sept	7.4	28	SW.	NE.	4	14	7	3	6	10	2	9	5	9	9	12	10	0	0	0	1	0
Oct	7.8	37	S.	NW.	2	2	5	8	1	14	7	15	8	4	6	21	15	0	1	0	1	0
Nov	8.7	33	SW.	SW.	3	2	4	5	3	16	6	16	5	10	8	12	8	0	6	0	0	0
Dec	10.0	36	W.	SW.	5	8	2	4	2	21	6	11	3	10	5	16	9	9	28	0	0	0
Means	8.7	....	.....	SW.	25	91	49	85	40	172	70	132	66	100	131	134	133	24	102	12	24	0

VALENTINE, NEBR.

[H=2,613. T=40.7. h=30.8.]

Jan	8.9	54	W.	W.	11	4	1	3	3	11	14	12	3	7	10	14	8	19	30	0	0	0
Feb	12.4	44	NW	N.	15	6	5	3	6	5	9	5	2	9	8	11	10	11	25	0	0	0
Mar	12.0	50	NW	NW.	12	4	8	7	7	4	6	14	0	7	12	12	11	6	25	0	1	0
Apr	11.7	54	N.	N.	14	8	1	6	11	3	9	6	2	17	8	5	5	0	11	0	1	0
May	14.1	48	N.	N.	15	9	2	7	9	2	7	11	0	11	13	7	10	0	5	1	2	0
June	14.0	52	NW	S.	12	11	5	6	14	2	2	8	0	14	11	5	13	0	0	5	6	0
July	11.1	48	S.	SE.	6	5	11	15	11	3	8	3	0	19	11	1	11	0	0	12	2	0
Aug	9.7	58	N.	S.	13	3	1	8	15	6	12	2	2	12	19	0	12	0	0	5	4	0
Sept	10.8	40	NW	S.	8	5	5	7	9	8	8	6	4	12	11	7	4	0	1	2	1	0
Oct	11.8	48	NW	W.	12	4	1	2	9	4	17	12	1	9	13	9	5	0	12	0	0	0
Nov	10.0	36	NW	W.	9	1	1	0	2	14	19	12	2	16	10	4	5	1	28	0	0	0
Dec	10.2	52	NW	SW.	8	4	2	5	5	12	10	9	7	12	13	6	2	6	29	0	0	0
Means	11.4	....	.....	N.	135	64	43	69	101	74	121	100	23	145	139	81	96	43	106	25	17	0

VICKSBURG, MISS.

H=222. T=59.7. h=53.5.]

Jan	7.4	30	NW	SE.	8	11	8	10	12	1	1	1	1	4	18	9	11	0	2	0	1	0
Feb	7.9	38	NW	S.	7	9	4	11	18	2	1	3	1	11	7	10	10	0	1	0	6	0
Mar	8.8	30	S.	SE.	10	14	5	15	14	0	0	3	1	11	6	14	7	0	4	0	5	0
Apr	7.6	36	W.	SE.	8	5	6	15	16	2	0	7	2	11	9	10	7	0	0	0	8	0
May	5.9	42	NE.	SE.	7	8	7	14	6	9	1	4	6	13	12	6	10	0	0	8	8	0
June	5.4	34	W.	SW.	2	6	6	8	14	18	3	1	2	7	15	8	13	0	0	12	15	0
July	4.6	22	SE.	SE.	4	8	11	20	8	9	2	3	2	6	14	11	13	0	0	22	10	0
Aug	4.9	24	SE.	SE.	12	5	5	20	8	3	4	3	2	9	13	9	10	0	0	14	8	0
Sept	4.8	28	E.	SE.	10	6	12	13	4	5	3	6	1	6	12	13	16	0	0	1	6	0
Oct.	5.2	30	SW.	N.	12	5	7	7	7	6	7	6	5	19	9	3	7	0	0	0	2	0
Nov	4.9	30	SW.	SE.	12	13	5	14	4	3	4	3	2	18	4	8	4	0	0	0	1	0
Dec.	6.6	30	SW.	N.	14	6	6	13	12	1	0	9	1	13	7	11	8	0	1	0	1	0
Means	6.2	....	.....	SE.	106	96	82	109	117	59	26	40	20	128	126	111	116	0	8	49	66	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

WALLA WALLA, WASH.

[Lat., 46° 2' N.; long., 118° 20' W.]

Months and year.	Pressure (actual.)		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	28.94	1.16	19.8	21.7	20.6	56	10	26.8	14.4	14	15	82	80	2.53	.54	7.7
Feb	28.95	1.22	28.5	32.8	31.1	67	—7	38.1	24.1	21	24	76	74	1.35	.43	6.2
Mar	28.95	1.35	37.3	47.4	42.9	68	—7	50.8	35.0	30	32	78	60	2.45	.71	6.5
Apr	28.96	.80	46.3	63.9	55.6	89	29	66.9	44.4	31	32	62	33	.38	.20	4.6
May	28.89	.88	53.9	72.5	63.0	90	40	74.7	51.2	39	36	59	30	1.36	.86	3.8
June	28.93	.64	55.5	74.1	65.2	101	46	77.0	53.4	41	37	66	28	1.42	.45	4.4
July	28.90	.43	61.7	84.9	73.2	106	48	87.4	58.9	42	37	50	20	.07	.05	1.8
Aug	28.90	.52	63.2	85.1	74.5	100	49	87.9	61.1	44	42	51	24	.14	.14	2.3
Sept	28.94	.54	56.3	77.2	66.6	90	36	79.7	53.6	39	38	55	27	.38	.20	2.1
Oct	29.02	.54	46.3	57.9	53.4	77	34	63.4	43.3	39	40	77	54	.77	.24	4.6
Nov	29.18	.69	38.2	48.1	44.6	60	25	54.3	34.8	31	34	79	61	.01	.01	2.9
Dec	29.00	1.17	41.4	45.0	43.2	65	25	51.0	35.5	32	35	75	74	.94	.26	6.2
Means	28.96	.83	45.7	59.2	52.8	106	—10	63.2	42.5	34	34	68	47	11.80	......	4.4

WASHINGTON CITY.

[Lat., 38° 53 N.; long., 77° 1' W.]

Jan	30.14	.96	39.8	44.4	43.8	76	19	51.7	35.8	33	33	78	66	1.54	.38	6.2
Feb	30.01	.89	39.2	44.2	43.4	73	24	51.2	35.7	33	34	79	71	4.20	1.69	6.1
Mar	29.97	1.11	36.4	42.3	41.4	77	13	50.0	32.7	28	29	74	61	3.65	.72	6.2
Apr	30.02	1.14	49.5	56.5	53.6	82	25	64.4	42.7	30	41	70	57	2.81	.70	4.6
May	29.86	.66	60.4	64.4	63.8	86	42	73.1	51.6	53	53	77	68	4.73	1.03	6.9
June	29.89	.61	71.9	75.8	74.8	92	50	84.3	65.2	61	61	70	68	2.02	.76	4.7
July	29.93	.54	72.0	75.8	75.0	98	53	84.5	65.6	63	63	75	68	3.24	1.07	4.7
Aug	29.94	.48	70.1	72.4	73.6	95	49	82.0	65.1	63	64	79	77	5.50	1.76	5.3
Sept	30.02	.43	64.4	66.9	67.8	87	44	76.0	59.5	59	60	83	80	4.22	1.53	6.0
Oct	29.83	0.91	52.7	55.8	56.4	77	30	63.3	49.4	46	47	79	74	5.15	3.39	6.3
Nov	30.00	.72	42.0	48.0	48.0	75	24	57 1	38.8	34	37	76	67	.79	.51	5.2
Dec	29.99	1.17	30.6	34.6	34.2	60	18	40.9	27.4	22	24	73	68	3.74	1.73	5.6
Means	29.77	0.80	52.4	56.8	56.3	98	13	64.9	47.7	44	46	76	69	41.59	......	5 6

WHIPPLE BARRACKS, PRESCOTT, ARIZ.

[Lat., 34° 33' N.; long., 112° 28' W.]

Jan	24.72	.54	23.5	35.6	32.9	63	3	44.7	21.1	18	22	79	62	2.29	1.11	3.8
Feb	24.71	.60	28.7	43.2	39.2	73	9	51.3	27.0	21	22	73	49	3.02	1.59	3.6
Mar	24.73	.66	34.6	51.6	45.2	69	20	58.2	32.3	25	31	68	54	1.52	1.16	3.5
Apr	24.70	.42	39.9	60.6	51.6	78	28	65.2	38.1	28	40	65	49	.86	.59	2.4
May	24.69	.34	47.1	72.0	59.2	86	34	75.7	42.6	27	24	48	18	.00	.00	2.0
June	24.74	.25	51.0	77.8	63.6	88	53	81.0	46.1	25	22	36	13	.06	.06	1.7
July	......	.16	......	80.6	73.6	93	53	87.2	59.9	......	49	......	36	2.74	.64	5.2
Aug	......	.21	......	74.8	69.0	88	50	81.2	36.9	......	55	......	54	4.02	1.24	6.2
Sept	......	.26	......	73.8	66.0	90	44	79.4	52.5	......	48	......	43	1.07	.27	4.8
Oct	......	[1].39	......	[1]58.0	[2]51.8	[2]72	[2]27	[2]35.1	[2]38.6	......	[1]35	......	[1]45	[2]1.60	[1]101	[1]3.5
Nov	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Dec	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Means	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

Annual Meteorological Summary for the Year Ending December 31, 1890—Continued.

WALLA WALLA, WASH.

[H=1,018. T=66. h=56.]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Mim. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	6.6	40	SE.	SW.	0	1	0	2	9	41	7	2	0	2	9	20	16	20	24	0	0	0
Feb	7.9	50	SW.	SW.	3	0	0	4	9	38	1	3	0	4	15	9	10	10	16	0	0	0
Mar	7.2	42	SW.	SW.	3	0	4	6	8	34	5	1	1	4	14	13	16	3	8	0	0	0
Apr	7.0	42	SW.	SW.	8	0	0	5	13	20	8	6	0	10	16	4	5	0	2	0	1	0
May	7.3	32	SW.	SW.	6	1	4	8	15	20	7	1	0	15	10	6	7	0	0	1	1	0
June	6.7	25	SE.	S.	3	1	2	6	21	20	1	5	1	10	16	4	8	0	0	3	1	0
July	7.0	28	SW.	S.	6	1	1	4	20	17	8	5	0	23	6	2	4	0	0	10	3	0
Aug	6.0	28	S.	S.	6	2	1	2	25	9	13	4	0	22	7	2	2	0	0	12	2	0
Sept	4.1	24	W.	S.	4	3	6	3	18	5	16	3	2	22	7	8	2	0	0	0	0	0
Oct	6.2	39	SW.	SW.	5	3	3	6	13	14	10	4	4	12	12	1	8	0	0	0	0	0
Nov	4.0	24	W.	S.	3	2	7	7	13	12	12	3	1	19	8	7	1	0	12	0	0	0
Dec	6.1	34	S.	SW.	4	2	3	5	18	21	6	1	2	6	13	12	13	1	9	0	0	0
Means	6.3	....	......	SW.	51	51	31	58	182	249	94	38	11	149	133	83	92	34	71	26	8	0

WASHINGTON CITY.

[H=112. T=59. h=42.]

Jan	7.4	40	NW.	S.	5	8	0	4	17	7	5	15	1	4	16	11	12	1	9	0	0	0
Feb	6.9	31	NW.	NE.	5	13	4	2	13	7	1	10	1	8	5	15	15	0	10	0	1	0
Mar	10.0	44	W.	NW.	13	6	0	6	6	7	8	16	0	7	12	12	18	3	15	0	0	0
Apr	7.2	36	NW.	S.	11	4	2	8	16	1	4	12	2	13	10	7	11	0	2	0	1	0
May	6.4	32	NW.	S.	11	5	6	7	13	5	3	9	3	4	14	13	16	0	0	0	5	0
June	5.2	36	S.	S.	11	2	7	3	15	8	4	9	1	10	17	3	9	0	0	4	5	0
July	5.3	18	S.	S.	5	10	7	5	19	7	1	5	2	13	10	8	9	0	0	7	3	0
Aug	5.8	33	W.	S.	7	11	1	3	13	4	6	17	0	8	15	8	17	0	0	1	5	0
Sept	5.3	24	NW.	S.	8	9	8	4	12	5	4	9	1	8	11	11	11	0	0	0	3	0
Oct	7.3	30	NW.	NW.	7	5	8	2	6	4	8	20	2	9	6	16	14	0	1	0	0	0
Nov	5.4	40	NW.	NW.	8	9	0	1	16	6	8	11	1	13	4	13	6	0	5	0	0	0
Dec	8.4	45	NE.	NW.	11	10	5	0	6	10	7	12	1	10	9	12	13	4	23	0	0	0
Means	6.8	....	......	S.	102	92	48	45	152	71	59	146	15	107	129	129	151	8	65	12	23	0

WHIPPLE BARRACKS, PRESCOTT, ARIZ.

[H=5,389.]

Jan	9.9	48	S.	SW.	1	1	1	2	8	41	5	0	3	17	5	8	7	1	25	0	0	0
Feb	12.7	65	SW.	SW.	7	4	1	1	8	25	9	0	1	16	3	9	7	0	19	0	0	0
Mar	11.6	55	W.	SW.	5	5	1	0	1	37	12	1	0	17	8	6	5	0	15	0	0	0
Apr	10.2	40	W.	SW.	4	1	3	0	0	38	11	3	0	20	7	3	5	0	3	0	1	0
May	8.2	36	SW.	SW.	1	0	0	1	4	33	16	4	3	23	8	0	0	0	0	0	0	0
June	8.4	32	SW.	SW.	5	2	1	1	3	35	10	0	3	25	3	2	1	0	0	0	0	0
July	7.2	38	SW.	SW.	1	1	2	1	1	22	3	0	0	8	17	6	14	0	0	8	8	0
Aug	4.6	34	SE.	SW.	3	3	2	0	2	19	2	4	0	5	12	14	18	0	0	0	15	0
Sept	5.1	30	SW.	SW.	5	3	0	1	1	5	8	3	0	9	15	6	10	0	0	0	7	0
Oct	9.1	[1]48	[1]SW.	[1]SW.	[1]3	[1]1	[1]1	[1]0	[1]0	[1]6	[1]4	[1]0	[1]0	[1]9	[1]2	[1]4	[1]5	[2]0	[2]2	[2]0	0	0
Nov	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Dec	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Means	......	....	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

[1]For 15 days. [2]For 17 days.

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

WICHITA, KANS.

[Lat., 37° 41′ N.; long., 97° 20′ W.]

Months and year.	Pressure (actual.)		Temperature.					Mean.		Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Maximum.	Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	28.69	1.13	24.9	31.9	30.0	70	0	39.8	20.3	21	26	87	78	2.12	0.74	5.6
Feb	28.60	.94	28.2	39.4	35.3	73	0	44.8	25.8	23	27	83	65	.35	.31	6.2
Mar	28.58	1.44	34.1	48.5	43.6	79	5	56.2	31.0	24	26	71	48	.14	.05	5.4
Apr	28.57	.72	49.2	61.4	57.0	91	32	67.2	46.7	43	47	82	64	3.03	.89	5.7
May	28.47	.57	57.2	70.1	64.5	90	36	76.2	52.8	49	52	74	54	2.17	.85	4.3
June	28.49	.65	70.0	82.5	77.2	98	52	88.2	66.3	62	61	76	50	5.05	2.50	3.6
July	28.53	.31	74.0	88.5	82.4	102	58	94.5	70.2	64	62	71	44	.05	.54	3.4
Aug	28.57	.38	68.6	81.0	77.2	102	59	88.5	66.0	62	62	82	56	2.00	1.82	4.6
Sept	28.62	.66	57.6	69.4	66.2	94	37	77.1	55.3	52	53	84	58	1.96	1.36	4.4
Oct	28.55	.72	48.8	61.0	58.0	86	33	69.6	46.5	43	45	81	50	2.39	2.20	3.1
Nov	28.70	.91	36.4	49.0	45.9	72	24	57.1	34.7	30	33	79	56	1.72	.99	2.6
Dec	28.68	1.18	31.3	41.6	39.7	72	10	50.7	28.7	22	25	71	54	.99	.82	3.8
Means	28.59	.80	48.4	60.4	56.4	102	0	67.5	45.4	41	43	78	57	24.07	.....	4.4

WILMINGTON, N. C.

[Lat., 34° 14′ N.; long., 77° 57′ W.]

Jan	30.22	.80	51.6	56.8	57.2	80	27	66.5	48.0	46	50	82	80	1.50	.93	5.7
Feb	30.06	.56	53.2	57.4	58.4	80	32	67.5	49.2	49	52	85	82	1.25	.49	5.5
Mar	30.03	.76	50.0	53.9	53.2	77	22	61.5	44.8	44	47	79	79	1.50	.54	5.2
Apr	30.08	.87	58.2	60.7	61.0	86	38	69.5	52.5	50	53	76	77	2.73	1.21	4.6
May	29.92	.59	68.7	70.3	70.8	90	50	79.1	62.6	62	63	81	79	5.26	2.12	5.2
June	29.96	.54	78.3	77.0	80.1	100	63	89.2	71.0	71	71	78	82	3.26	1.24	5.7
July	29.99	.57	76.8	76.3	77.4	92	58	84.4	70.4	70	71	81	84	8.22	2.74	6.0
Aug	30.01	.46	75.0	74.6	76.4	89	60	83.4	69.5	68	69	81	82	6.48	1.44	5.7
Sept	30.03	.34	72.1	72.9	74.0	89	58	80.5	67.6	68	69	88	87	8.10	3.54	5.9
Oct	29.91	.65	60.5	63.3	63.9	86	38	71.9	55.9	55	56	82	77	1.88	.98	4.7
Nov	30.08	.57	51.2	57.3	57.4	80	32	66.9	48.0	46	50	83	77	.36	.31	3.8
Dec	30.06	1.00	41.4	46.5	47.4	74	26	57.1	37.7	36	39	80	77	.61	.23	4.6
Means	30.03	.64	61.4	63.9	64.8	100	22	73.1	56.4	55	58	81	80	41.33	......	5.2

WINNEMUCCA, NEV.

[Lat., 40° 58′ N.; long., 117° 43′ W.]

Jan	25.58	.84	11.2	19.7	14.7	48	−23	23.9	5.5	5	10	77	68	2.96	1.40	5.3
Feb	25.60	1.08	25.7	35.8	30.6	57	−22	39.6	21.5	17	19	70	53	1.48	.55	5.5
Mar	25.64	.90	32.7	45.0	38.8	61	7	48.3	29.3	26	23	75	48	2.87	.78	5.7
Apr	25.65	.74	38.6	58.3	48.5	79	20	61.2	35.8	26	19	64	26	.68	.46	3.9
May	25.61	.62	48.7	67.6	58.1	88	32	70.4	45.8	36	27	63	20	1.30	.44	4.5
June	25.64	.52	49.2	72.0	60.2	91	34	74.1	46.4	30	19	49	14	.07	.07	2.8
July	25.66	.36	58.1	86.8	71.6	99	44	88.9	54.4	25	17	29	8	.01	.01	1.8
Aug	25.67	.35	56.1	82.3	68.8	95	42	85.6	52.0	31	24	43	14	.24	.09	2.0
Sept	25.68	.35	47.1	76.3	60.1	84	30	78.7	41.5	18	16	33	14	.47	.42	2.1
Oct	25.73	.61	35.5	57.4	46.5	74	22	62.2	30.8	20	17	55	25	.17	.10	3.7
Nov	25.84	.85	24.3	49.9	37.6	69	9	56.4	18.7	8	5	52	17	.00	.00	1.9
Dec	25.75	1.02	25.2	38.5	32.3	54	11	43.2	21.4	20	21	80	52	1.02	.59	5.9
Means	25.67	.69	37.7	57.5	47.3	99	−23	61.0	33.6	22	18	58	31	11.27	......	3.8

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

WICHITA, KANS.

[H=1,366. T=78. h=70.9.]

Months and year.	Wind.													Number of days—								
	Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	9.1	30	N.	N.	17	6	2	7	14	7	3	5	1	11	11	9	9	10	21	0	1	0
Feb	9.2	38	NW	N.	15	14	1	10	10	2	0	4	0	7	7	14	5	5	19	0	0	0
Mar	11.4	54	NW	NE.	14	17	5	7	7	6	2	2	2	11	11	9	5	2	16	0	2	0
Apr	10.4	42	NW	S.	7	13	3	7	14	6	2	6	2	11	7	12	12	0	1	1	2	0
May	10.1	36	S.	N.	18	4	0	6	16	7	2	6	3	10	16	5	13	0	0	0	10	0
June	10.0	34	S.	S.	6	1	3	10	25	10	2	2	1	13	12	5	3	0	0	14	9	0
July	7.9	32	N.	S.	4	5	3	18	27	0	3	1	1	18	9	4	5	0	0	25	8	0
Aug	7.0	27	NW	SE.	5	9	5	22	14	2	0	2	3	13	12	6	9	0	0	11	15	0
Sept	7.7	38	N.	NE.	12	15	2	14	12	1	0	1	3	13	12	5	5	0	0	5	3	0
Oct	8.3	33	N.	S.	13	5	3	10	14	4	2	10	1	20	5	6	6	0	0	0	5	0
Nov	7.6	34	NW	N.	14	6	3	5	9	6	3	13	1	23	2	5	6	0	10	0	0	0
Dec	8.7	32	N.	N.	19	7	1	12	12	5	1	5	0	18	5	8	3	3	24	0	1	0
Means	9.0	....	.....	S.	144	102	31	128	174	56	20	57	18	168	109	88	81	20	91	56	56	0

WILMINGTON, N. C.

[H=78. T=82. h=76.]

Jan	7.8	30	SW.	NE.	5	19	1	2	6	17	5	6	1	6	15	10	10	0	2	0	0	0
Feb	8.5	36	SW.	SW.	6	13	1	4	4	21	3	3	1	8	11	9	10	0	0	0	0	0
Mar	9.9	36	SW.	SW.	8	5	6	5	10	19	4	5	0	10	11	10	11	0	9	0	1	0
Apr	8.2	28	SW.	SW.	8	8	6	1	7	18	2	8	2	13	10	7	7	0	0	0	1	0
May	7.4	29	SW.	SW.	5	7	5	2	15	21	4	2	1	8	15	8	6	0	0	0	4	0
June	6.0	24	W.	SW.	3	9	4	6	8	18	6	6	0	4	20	6	12	0	0	15	7	0
July	7.9	24	SW.	SW.	0	10	7	4	6	24	6	5	0	6	14	11	16	0	0	8	7	0
Aug	6.2	30	NW	SW.	5	7	5	2	12	15	6	6	4	6	15	10	17	0	0	0	5	0
Sept	6.9	25	W.	NE.	10	15	4	5	7	5	4	2	8	7	12	11	19	0	0	0	0	0
Oct	8.4	36	SW.	NW.	3	11	0	2	1	14	11	18	2	18	6	7	10	0	0	0	1	0
Nov	5.6	24	SW.	NE.	7	11	6	0	6	10	5	8	7	17	8	5	2	0	0	0	0	0
Dec	8.0	36	NW	NE.	5	13	4	5	1	9	6	10	9	16	6	9	7	0	6	0	0	0
Means	7.6	....	.....	SW.	65	128	49	38	83	191	62	79	35	119	143	103	127	0	17	18	26	0

WINNEMUCCA, NEV.

[H=4,340. T=62.0. h=54.2.]

Jan	11.2	45	S.	NE.	7	18	5	5	8	14	2	1	2	13	8	10	13	24	31	0	0	0
Feb	14.1	54	SW.	SW.	6	3	1	1	14	24	1	5	1	11	5	12	9	7	22	0	0	0
Mar	11.0	60	SW.	SW.	8	7	3	2	14	18	4	5	1	10	8	13	12	0	19	0	0	0
Apr	10.2	60	SW.	SW.	5	6	3	7	7	20	3	7	2	15	7	8	6	0	7	0	2	0
May	9.8	48	SW.	N.	12	7	8	1	9	8	7	6	4	9	16	6	9	0	0	0	4	0
June	10.6	46	SW.	W.	4	6	10	0	8	11	17	3	1	17	18	0	2	0	0	1	0	0
July	9.5	36	SW.	SW.	4	2	5	0	8	25	12	2	4	25	6	0	1	0	0	12	2	0
Aug	9.1	54	E.	E.	5	6	13	2	8	12	6	8	2	18	12	1	7	0	0	4	4	0
Sept	8.7	46	NW	NE.	7	16	9	0	1	16	2	7	2	23	4	3	2	0	2	0	2	0
Oct	8.7	38	NE.	SW.	12	12	8	0	2	18	3	4	3	16	10	5	6	0	20	0	0	0
Nov	8.2	36	N.	E.	6	18	19	1	4	5	1	1	5	23	7	0	0	0	29	0	0	0
Dec	7.9	38	W.	E.	2	11	21	1	5	12	7	1	2	7	12	12	6	0	27	0	0	0
Means	9.9	....	.....	SW.	78	112	105	20	88	183	65	50	20	187	108	70	73	31	157	17	14	0

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

WOODS HOLL, MASS.

[Lat., 41° 33′ N.; long., 70° 40′ W.]

Months and year.	Pressure (actual).		Temperature.							Dew-point.		Relative humidity.		Precipitation.		Mean cloudiness (in tenths).
	Mean.	Absolute range.	8 a. m.	8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean. Maximum.	Mean. Minimum.	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Total.	Max. in 24 hours.	
1890.	In.	In.	°	°	°	°	°	°	°	°	°	%	%	In.	In.	
Jan	30.16	1.50	34.8	37.5	35.8	55	14	42.0	29.6	30	31	84	79	2.36	.86	6.9
Feb	80.09	1.20	33.9	34.2	34.5	56	12	40.1	28.9	29	29	84	82	2.84	.76	6.3
Mar	29.96	1.30	33.0	35.6	34.2	49	10	39.1	29.3	29	30	84	83	8.39	1.96	6.0
Apr	30.07	1.05	42.0	43.8	43.6	58	28	49.3	38.0	37	39	83	85	2.78	1.33	5.1
May	29.97	.67	53.0	52.4	52.6	66	42	57.2	48.0	49	50	88	92	2.72	.56	5.8
June	29.97	.58	60.8	60.8	61.2	76	50	66.5	56.0	56	56	86	86	5.25	3.42	5.7
July[1]	....	.49	......	67.0	67.6	81	55	72.9	62.4	....	63	.....	87	2.55	.84	4.7
Aug	....	.54	......	68.2	67.8	78	55	72.4	63.1	....	64	.....	87	4.65	2.42	4.8
Sept	....	.64	......	63.6	63.5	76	44	68.5	58.5	....	61	.....	90	4.70	1.71	4.6
Oct	....	1.04	......	52.6	52.2	70	40	56.3	48.0	....	48	.....	86	9.79	4.50	6.9
Nov	....	.80	......	43.6	43.1	62	18	49.6	36.6	....	39	.....	85	1.31	.46	5.6
Dec	....	1.11	......	30.6	29.2	54	6	37.3	21.2	....	26	.....	85	3.90	1.78	6.3
Means	....	.91	......	49.2	48.8	81	6	54.3	43.3	....	45	.....	86	51.24	......	5.7

[1] 8 a. m. observations discontinued July 1, 1890.

YANKTON, S. DAK.

[Lat., 42° 54′ N.; long., 97° 28′ W.]

Months and year.	Pressure Mean.	Pressure Absolute range.	Temp. 8 a. m.	Temp. 8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean Maximum.	Mean Minimum.	Dew-point 8 a. m.	Dew-point 8 p. m.	Rel. hum. 8 a. m.	Rel. hum. 8 p. m.	Precip. Total.	Max. in 24 hours.	Mean cloudiness.
Jan	28.82	1.24	6.7	13.8	11.4	56	—22	19.7	3.2	1	8	78	80	.56	.29	5.6
Feb	28.75	1.16	14.5	23.0	21.0	60	—17	30.8	11.3	8	14	75	70	.46	.19	6.5
Mar	28.74	1.15	22.7	31.5	28.6	56	— 7	37.4	19.7	16	21	76	67	1.07	.62	6.5
Apr	28.70	1.08	43.9	57.8	51.4	86	15	63.5	39.4	33	35	60	47	1.84	.79	5.0
May	28.56	.75	50.4	63.7	56.2	88	32	68.0	44.5	40	42	70	48	4.18	1.73	6.2
June	28.56	.77	65.9	76.4	70.9	93	50	80.6	61.2	58	60	78	50	3.59	1.41	5.2
July	28.63	.64	69.7	80.9	75.9	98	51	86.4	65.4	60	63	74	56	4.27	2.70	3.6
Aug	28.60	.68	61.3	75.1	69.6	99	41	81.2	58.0	52	56	74	54	2.16	1.18	4.1
Sept	28.73	.93	52.8	66.2	62.4	93	33	75.3	49.4	46	48	78	52	1.16	.60	3.5
Oct	28.64	.84	40.3	52.4	49.8	75	22	61.2	28.3	36	41	85	67	.92	.50	4.6
Nov	28.79	.97	29.1	40.7	39.2	74	9	51.1	27.2	24	30	81	67	.79	.50	3.5
Dec	28.77	.88	21.8	31.5	31.0	67	— 7	42.9	19.0	16	20	77	63	.25	.14	3.4
Means	28.70	.92	39.9	51.1	47.3	99	—22	58.2	36.4	32	36	76	61	21.25	......	4.8

YUMA, ARIZ.

[Lat., 32° 45′ N.; long., 114° 36′ W.]

Months and year.	Pressure Mean.	Pressure Absolute range.	Temp. 8 a. m.	Temp. 8 p. m.	Mean (max. and min.).	Maximum.	Minimum.	Mean Maximum.	Mean Minimum.	Dew-point 8 a. m.	Dew-point 8 p. m.	Rel. hum. 8 a. m.	Rel. hum. 8 p. m.	Precip. Total.	Max. in 24 hours.	Mean cloudiness.
Jan	29.94	9.55	42.5	58.7	51.4	80	30	63.4	39.5	34	38	73	48	T.	T.	2.6
Feb	29.89	.60	49.7	66.7	58.4	86	36	70.5	46.3	33	34	56	33	.86	.83	2.0
Mar	29.84	.74	54.4	75.2	64.8	90	44	78.1	51.4	34	31	47	21	T.	T.	4.4
Apr	29.75	.37	58.3	83.7	71.2	98	46	86.8	55.7	41	33	56	17	T.	T.	2.7
May	29.66	.43	64.4	91.8	78.0	106	54	94.4	61.6	46	31	52	15	.00	.00	.7
June	29.65	.27	70.5	97.1	83.8	107	61	100.1	67.5	48	34	48	12	.00	.00	.8
July	29.64	.36	81.6	101.6	92.2	115	74	105.5	78.9	65	59	58	27	T.	T.	3.4
Aug.	29.67	.36	79.2	96.5	89.2	110	68	101.5	76.8	67	62	67	35	.83	.53	3.6
Sept	29.66	.39	77.4	95.0	87.7	110	67	100.4	75.0	65	59	67	33	.64	.64	3.5
Oct	29.74	.51	60.8	80.8	72.6	95	47	88.0	57.3	42	40	55	26	1.70	1.70	1.3
Nov	29.88	.50	56.3	70.8	65.2	91	40	78.2	52.1	31	32	42	26	.12	.12	1.3
Dec	29.92	.51	53.7	64.9	60.2	77	35	70.2	50.2	37	39	56	42	.52	.31	4.3
Means	29.77	.47	62.4	81.9	72.9	115	30	86.4	59.4	45	41	56	28	4.67	......	2.6

ANNUAL METEOROLOGICAL SUMMARY FOR THE YEAR ENDING DECEMBER 31, 1890—Continued.

WOOD'S HOLL, MASS.

[H=22. T=51. h=39.3.)

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
1890.																						
Jan	18.8	65	NW.	NW.	4	3	7	4	2	13	14	15	0	8	6	17	13	0	17	0	0	0
Feb	17.8	60	NW.	NW.	5	8	6	10	3	5	4	15	0	8	6	14	17	4	16	0	0	0
Mar	18.3	48	N.	NW.	9	4	4	1	6	8	9	21	0	8	11	12	18	5	18	0	1	0
Apr	14.9	48	SW.	SW.	12	6	3	7	7	13	7	5	0	14	6	10	11	0	4	0	0	0
May	15.0	45	SW.	SW.	6	6	3	11	6	21	4	4	1	9	11	11	14	0	0	0	2	0
June	12.2	37	W.	W.	8	7	4	6	4	11	13	7	0	9	12	9	13	0	0	0	0	0
July	13.1	40	S.	SW.	0	2	2	6	3	9	8	1	0	12	15	4	12	0	0	0	3	0
Aug	12.7	48	SW.	SW.	1	2	1	5	2	11	5	4	0	10	18	8	8	0	0	0	2	0
Sept	13.6	36	SW.	SW.	1	5	3	1	3	11	2	4	0	15	7	8	12	0	0	0	1	0
Oct	15.6	60	NW.	NW.	3	5	4	6	0	3	1	8	1	7	10	14	15	0	0	0	0	0
Nov	17.9	54	SE.	NW.	5	2	0	3	1	7	4	8	0	8	15	7	5	1	8	0	0	0
Dec	21.6	60	NW.	NW.	5	5	1	2	1	3	5	9	0	8	11	12	11	9	26	0	0	0
Means	16.0	....	....	SW.	59	55	38	62	33	116	76	101	2	116	128	121	149	25	89	0	9	0

YANKTON, S. DAK.

[H=1,232.1. T=50.40. h=42.31.

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	8.8	31	S.	NW.	2	3	5	4	3	8	12	21	4	9	11	11	6	21	30	0	0	1
Feb	11.8	39	N.	NW.	6	2	2	5	4	9	6	21	1	5	10	13	5	14	20	0	0	0
Mar	10.8	48	NW.	NW.	6	8	8	10	2	6	8	11	3	7	10	14	9	11	26	0	0	0
Apr	11.0	48	NW.	SE.	4	11	6	15	3	6	4	11	0	11	9	10	6	0	4	0	2	0
May	12.0	54	S.	NW.	7	5	5	6	6	9	8	16	0	7	11	13	13	0	0	0	0	0
June	10.1	70	SE.	SE.	2	8	9	13	8	4	6	10	0	7	17	6	13	0	0	5	5	0
July	9.0	47	SW.	SE.	5	10	10	12	5	7	5	8	0	17	9	5	9	0	0	12	1	0
Aug	9.0	38	SW.	SE.	3	7	10	17	3	7	4	10	1	13	14	4	9	0	0	6	6	0
Sept	9.6	40	NW.	SE.	1	4	8	16	9	5	4	12	1	16	12	2	7	0	0	1	3	0
Oct	9.3	39	NW.	NW.	0	6	8	7	4	3	13	21	0	12	10	9	9	0	5	0	1	0
Nov	8.1	39	S.	NW.	1	7	0	1	2	7	16	25	1	20	6	4	5	1	22	0	0	0
Dec	9.0	54	NW.	NW.	2	6	5	3	9	7	9	20	1	17	12	2	4	8	29	0	0	0
Means	9.8	....	....	NW.	39	77	76	109	58	78	95	186	12	141	131	93	95	55	142	24	24	1

YUMA, ARIZ.

[H=141. T=16. h=1]

Months and year.	Wind. Average hourly velocity.	Maximum.	Direction.	Prevailing direction.	North.	Northeast.	East.	Southeast.	South.	Southwest.	West.	Northwest.	Calms.	Number of days— Cloudless.	Partly cloudy.	Cloudy.	Rainy.	Max. below 32°.	Min. below 32°.	Max. above 90°.	Thunderstorms.	Auroras.
Jan	5.3	28	N.	N.	20	16	6	5	5	2	5	3	0	24	5	2	0	0	5	0	0	0
Feb	8.3	33	N.	N.	22	9	4	1	5	3	9	3	0	22	3	3	5	0	0	0	0	0
Mar	8.6	46	W.	N.	19	14	4	0	5	4	14	2	0	12	12	7	0	0	0	2	0	0
Apr	6.6	32	W.	S.	7	2	7	3	12	9	11	6	3	18	10	2	0	0	0	8	0	0
May	7.5	36	W.	W.	3	2	3	5	10	15	22	0	2	29	2	0	0	0	0	23	0	0
June	6.7	24	W.	W.	9	5	5	6	10	10	12	2	1	27	3	0	0	0	0	30	0	0
July	8.2	40	W.	S.	2	6	2	7	21	14	8	2	0	15	16	0	0	0	0	31	3	0
Aug	6.7	42	E.	S.	2	7	2	10	15	12	12	2	0	15	16	0	8	0	0	31	4	0
Sept	5.9	26	NE.	W.	3	7	3	9	6	11	17	3	1	17	10	3	1	0	0	27	1	0
Oct	6.5	34	SW.	NE.	13	18	9	0	5	5	9	3	0	25	5	1	2	0	0	15	1	0
Nov	7.2	44	N.	N.	36	11	2	1	1	8	2	3	1	25	5	0	1	0	0	1	0	0
Dec	7.0	36	W.	N.	33	10	7	0	3	2	4	2	1	13	10	3	5	0	0	0	0	0
Means	7.0	....	....	N.	169	107	54	47	98	90	125	31	9	242	97	26	22	0	5	168	9	0

APPENDIX 14.

TEMPERATURE DATA, 1890, FROM SIGNAL SERVICE AND VOLUNTARY OBSERVERS.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURES FOR 1890, COMPILED FROM THE REPORTS OF REGULAR SIGNAL-SERVICE OBSERVERS, VOLUNTARY AND STATE WEATHER-SERVICE OBSERVERS, UNITED STATES POST SURGEONS, OBSERVERS OF THE NEW ENGLAND METEOROLOGICAL SOCIETY, AND OPERATORS AND AGENTS OF THE PACIFIC RAILWAY SYSTEM.

[Many of the voluntary observers do not have standard thermometers or shelters. The hours of observation at voluntary stations are not uniform. Many observers make but one observation per day, using self-registering thermometers; others observe at 7 a. m., 2 and 9 p. m.; and still others at 8 a. m. and 8 p. m., 7 a. m. and 7 p. m., etc. Letters of the alphabet denote number of days missing from the record; thus, "*c*" denotes that three days are missing. Interpolated values, derived from the data for adjacent stations, are given in brackets.]

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Alabama:													
Auburn	55.4	58.2	53.6	64.6	*a*69.8	79.6	80.2	78.2	73.8	63.6	60.8	50.0	65.7
Bermuda	59.0	59.7	50.9	64.8	69.2	77.6	79.9	77.0	72.5	62.7	56.4	52.0	65.1
Butler	58.0		54.1	66.1	71.7								
Carrollton			52.5	64.5	69.7	79.3	79.9	75.2	73.7				
Chepultepec					64.9	72.8	79.0	72.1					
Citronelle	63.1	64.0	58.5	68.8	74.2	81.4	82.0	80.7	77.4	68.4	63.6	55.8	69.8
Columbiana	56.6	56.5	51.9	64.7	69.1	78.3	76.7	76.3	72.3	61.2	56.0	47.9	64.0
Decatur						80.1	79.4	75.5	70.9	59.2	53.8		
Double Springs	53.8	55.3	50.8	63.4	68.1	78.2	[80.0]	74.3	71.5	58.7	46.7	47.3	[62.3]
Elkmont	50.2		48.8	60.8		80.0							
Eufaula					72.6	77.6	80.0	78.9	73.0	66.8	60.3		
Evergreen					*l*71.8	80.8	81.2	79.0	75.8	64.8	59.0		
Florence			49.0	61.8		82.1	80.9	75.9	72.5	61.6			
Fort Deposit					*e*72.2	81.4	81.5	*n*74.9		64.9	59.6		
Gadsden	51.0		49.3	65.2	68.9	79.5							
Goodwater						83.3	83.5	81.3	78.8				
Greensboro	57.0	[60.0]	53.6	61.5	70.9	79.9	79.8	78.8	73.5	59.1	[58.0]	48.3	[65.0]
Guntersville			48.7	59.2	64.9	76.7	76.7						
Jasper			55.0		69.9	78.1	79.6	75.7	72.3				
Livingston[1]	57.2	57.7	54.0	64.7	70.3	77.0	80.0	79.4	72.1	59.1	56.2	48.0	64.6
Livingston[2]					68.0	77.0	79.4	77.5	73.3	62.4	*g*57.6		

[1] Prof. J. W. A. Wright.

[2] Cotton-belt observer.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Alabama—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
Marion					68.6	78.2	78.9	78.6	73.2	62.3	57.6		
Mobile	62.0	61.4	57.1	68.0	72.7	80.0	80.5	79.6	76.6	66.7	61.1	54.1	68.3
Montgomery	57.4	59.8	55.6	66.6	72.2	81.1	81.6	79.4	75.8	64.9	60.1	51.6	67.2
Mount Vernon Barracks	61.6	61.0	55.6	66.4	71.2	77.8	78.6	78.0	74.2	63.0	59.8	52.3	66.6
Mount Willing			54.0	66.3	70.5	79.7	80.4	78.9	76.0	63.5		49.5	
Opelika					71.2	[e]79.8	80.6	77.6	72.7	60.8	57.6		
Pine Apple					71.6	81.2	81.0	78.8	75.6	63.5			
Selma					73.5	81.6	82.6	80.0	76.3	63.9	52.2		
Tuscumbia[1]	51.4		56.0	61.6	66.9	78.5				57.9	53.7	45.7	
Tuscumbia[2]					67.8	80.5	79.6	75.7	71.3	56.7	55.1		
Union Springs			55.7	68.0	72.7	80.9	80.3	83.0	75.4	65.6	62.5	50.3	
Uniontown				65.6	72.4	79.6	81.0	79.0	74.5	64.1	59.4	52.3	
Valley Head	49.6	50.8	46.2	60.0	65.3	75.6	75.2	71.6	68.8	55.1	50.2	41.8	59.2
Wiggins	60.9	61.2	56.5	67.9									
Alaska:													
Juneau	17.4	22.4	31.4	34.7	48.0	53.2	57.4	55.6	50.6	42.3	39.2	29.0	40.1
Killisnoo	20.4	20.0	32.8	31.4	44.1	54.3	56.4	55.8	50.5	40.3	36.8	31.3	39.5
Arizona:													
Agua Caliente	56.6	56.2	61.6	68.0	74.2								
Arizona Canal								83.8	85.4	71.9	62.4	57.7	
Ash Springs	44.0	47.8	56.0	62.0	73.6	80.1	80.0	75.6	71.2	[69.0]	[50.0]	[42.0]	[62.6]
Bangharts		42.6	50.0			70.4		75.3	68.8	55.1	43.3	45.3	
Benson	44.5	48.5	59.6	66.2	79.0	86.3	[78.0]	81.9	75.6	64.2	53.7	52.4	[65.8]
Bisbee						76.0	74.9	70.0	67.2	59.2	49.6	48.2	
Casa Grande	51.8	56.1	66.2	70.8	83.7	88.4	94.1	86.9	87.0	74.1	68.1	62.3	74.1
Cooleys Springs							[b]68.6	64.2	59.6	[e]48.4			
Dragoon Summit								77.4	74.2	69.8	55.2	55.4	
Eagle Pass	34.9	38.8	45.3	53.5	66.3	72.7	78.8	72.6	69.4	54.2	[40.4]	42.4	55.8
Farleys Camp									84.0	74.6	56.6	55.5	
Florence	49.4	[50.0]	60.0	68.0	76.2	82.2	91.2	84.4	82.6	66.1	58.3	[60.0]	[68.2]
Fort Apache[3]	37.9	41.2	46.9	53.6	62.7	67.8	74.6	70.5	67.8	55.3	45.5	43.2	55.6
Fort Apache[4]	38.4	41.4	46.7	53.4	62.0	67.3	75.0	70.5	67.3	54.3	45.1	42.8	55.4

Fort Bowie[3]	45.0	49.4	54.8	61.2	71.2	76.4	77.4	71.7	69.5	60.8	50.4	46.1	61.2
Fort Bowie[4]	44.8	48.2	54.2	60.9	71.4	76.6	b78.0	72.0	69.7	60.4	48.5	46.1	60.9
Fort Grant[3]	45.4	48.4	53.8	59.0	69.6	74.6	78.0	72.6	70.2	61.4	50.2	48.6	61.0
Fort Grant[4]	45.4	48.4	53.8	59.0	69.6	74.6	78.0	72.6	70.4	61.4	50.8	48.6	61.0
Fort Huachuca	42.1	43.8	[52.0]	60.1	71.2	75.0	79.0	71.2	69.5	62.0	50.2	47.6	[60.3]
Fort Lowell	49.8	52.4	58.5	65.1	71.9	78.2	86.1	80.2	80.0	67.2	58.0	60.6	67.3
Fort McDowell	48.9	54.2	59.0	67.3	75.4	81.4	92.3	86.1	83.7	70.5	[60.0]	[54.0]	[69.4]
Fort Mojave	44.0	52.8	58.7	70.0	78.4	83.4	94.9	89.9					
Fort Verde[3]	41.0			58.0	68.9	73.0	84.7	78.2	e75.8				
Fort Verde[4]	41.8	46.2	52.2	60.5	69.6	74.4	85.5						
Gila Bend[5]	50.6	85.9	64.0	73.3	84.0	89.8	95.8	88.4	86.9	74.7	66.0	60.7	74.2
Gila Bend[6]								94.3	92.0	73.3	66.1	63.6	
Holbrook	33.7	41.0	47.6	55.2	62.4	67.0	77.6	73.6	66.2	51.8	41.6	38.0	54.6
Lochiel	44.3	46.0	52.8	[65.0]	[75.0]	f75.6	75.2	70.5	69.2	57.5	48.0	47.4	[60.5]
Maricopa	58.8	58.6	65.3	74.9	84.8	95.1	100.2	89.7	88.2	69.4	65.8	53.2	75.3
Mount Huachuca	46.8	50.8	57.8	63.6	d70.4	75.3	77.4	70.6	68.8	59.5	49.3	[48.0]	[61.5]
New River	[40.0]	[42.0]	[48.0]	65.9	72.2	77.6	88.4	82.9	f79.2	64.6	58.6	54.3	[64.5]
Pantano	46.6	50.7	56.5	67.0	76.6	87.9	85.7	78.4	77.4	71.9	64.0	54.0	68.1
San Carlos	46.5	51.0	57.0	d63.4		78.4	87.8				54.8	51.7	
San Simon	52.7	55.0	60.0	64.5	77.3	75.0	86.4	82.8	73.4	73.8	58.0	56.1	67.9
Signal	45.5	51.5	58.2	66.2	69.9	80.7	92.1	87.4	82.9	67.2	58.4	53.9	67.8
Texas Hill	46.7	47.8	64.3	73.1	83.4	89.0	97.7	94.7	89.4	72.9	59.6	56.5	71.9
Tombstone		49.4			71.8	78.2	79.7	75.6	73.5	63.9			
Tucson[7]	47.8	51.9	62.5	67.4	76.0	81.7	89.2	81.7	80.5	67.0	57.4	55.6	68.2
Tucson[6]	50.7	51.6	60.3	67.2	78.5	94.4	94.3	90.4	89.6	77.8	58.0	57.5	72.5
Whippe Barracks[3]								70.4	67.2	54.2	43.8	40.6	
Whipple Barracks (Prescott).[4]	32.9	39.2	45.2	51.6	59.2	63.6	73.6	69.0	66.0	q51.8	[44.0]	[41.0]	[53.1]
Wilcox[6]	48.5	51.8	59.8	65.6	73.9	83.5	83.3	77.2	75.6	65.6	53.5	47.5	65.5
Wilcox[4]	53.2	57.3	66.3	72.3	81.4	86.3	93.4	90.3	87.9	69.6	62.3	59.9	73.3
Yuma[6]	51.4	58.4	64.8	71.2	78.0	83.8	92.2	89.2	87.7	72.6	65.2	60.2	72.9
Yuma[4]	43.9	46.7	53.6	59.5	66.8	72.9	79.8	75.1	71.4	58.4	47.6	41.4	60.0
Arkansas:													
Brinkley					67.1	77.2	79.7				52.4		
Camden	[55.0]	54.0	54.2	64.5	69.7	76.9	81.2	78.4	71.9	61.7	55.0	48.0	[64.2]
Conway	49.8	50.4	50.8	62.8	69.5	78.9	81.3	77.0	69.5	58.0	52.0	44.4	62.0
Duvalls Bluff					69.8	79.0	80.7	77.6	70.9	60.4	52.8	44.5	
Forrest City	53.4	54.3	54.1	65.4	70.4	79.8	80.2	76.8	70.9	62.6	59.6	50.6	64.8

[1] L. B. Thornton. [2] Cottonbelt. [3] U. S. post surgeon. [4] Signal Service. [5] Daniel Murphy. [6] Pacific Railway System. [7] E. L. Wetmore.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Arkansas—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
Fort Smith	46.4	48.0	50.4	62.2	69.0	78.3	82.6	77.9	69.8	60.2	53.6	45.0	62.0
Harrisburg	48.0	47.4	47.2	61.1	69.1	78.2	[80.0]	[77.0]	65.0	57.8	50.5	42.4	[60.3]
Heber	47.7		48.7	61.4	62.8	76.4							
Helena					70.0	80.2	81.8	78.6	72.6		54.4	44.4	
Hot Springs	51.3	53.2					80.2	78.4	69.9	60.5	50.3	44.2	
Lead Hill	45.6	44.3	46.4	62.4	67.0	80.1	82.4	78.3	68.5	59.9	51.2	41.6	60.6
Little Rock[1]	51.5	52.4	51.0	62.4	69.8	78.6	82.0	78.9					
Little Rock[2]	50.0	51.0	50.6	62.3	69.1	78.2	81.3	78.0	70.6	61.6	55.1	45.9	62.8
Lonoke	53.7	53.8	[50.0]	66.1	72.7	80.8	83.2	79.9	72.9	63.1	57.8	49.1	[65.3]
Malvern					66.1	76.3	79.4	78.8	72.0	66.1	57.7		
Newport					67.2	78.3	80.2	75.6	68.4	59.4	52.0	42.4	
Osceola	[49.0]	49.2	48.2	62.3	68.1	79.3	79.2	76.7	68.0	58.9	53.2	44.4	[61.4]
Ozone	45.2	44.7	46.0	59.0	66.4	75.8	77.6	73.7	66.0	57.2	51.4	42.5	58.8
Pine Bluff	54.7	53.5	54.7	65.4	71.8	80.8	83.4	80.3	73.4	63.0	56.2	48.2	65.4
Prescott					70.8	78.6	82.4	79.6	72.1	61.8	55.6		
Russellville					70.4	79.6	82.0	78.8	71.3	60.8	54.4	45.2	
Stuttgart	50.7	51.0	51.7	63.3	69.8	79.4	85.1	77.0	70.1	59.2	53.7	45.5	63.0
Texarkana	54.7	57.0	53.0	65.1	72.0	79.8	84.1	81.5	74.0	64.4	57.8	50.8	66.2
Washington	56.2	51.3	54.0	64.9	73.1	76.2			73.8	63.5			
Winslow	39.9	45.1	44.2	57.4	64.8	75.7	77.7	74.5	67.1	56.8	51.9	42.0	58.1
California:													
Alcade	44.0	48.6	[55.0]	62.0	71.9	75.1	85.8	83.9	76.0	67.2	57.2	45.1	[64.3]
Alcatraz Island	44.5	47.6	52.3	53.2	56.1	55.5	54.8	56.9	56.8	59.0	56.4	47.4	53.4
Almaden	45.2	48.8	54.3	56.1	63.3	63.7	67.5	68.6	67.6	62.5	57.7	50.4	58.0
Anaheim	53.8	58.3	59.6	65.0	68.6	74.0	77.9	75.5	73.4	68.7	66.4	60.2	66.8
Anderson	38.2	46.2	48.0									48.8	
Angel Island	44.1	48.3	52.1	53.0	57.7	59.8	58.9	60.6	61.0	62.2	59.0	47.7	55.4
Antioch	43.3	48.0	52.6	60.4	69.5	79.5	80.2	76.1	69.9	64.1	58.8	49.4	62.6
Aptos	46.2	49.0	53.6	[53.0]	61.0	61.9	62.0	62.6	61.2	59.3	55.0	54.4	[56.6]
Athlone	45.3	50.2	57.1	63.8	71.2	75.8	82.7	81.7	74.0	65.7	55.6	46.9	64.2
Auburn	40.8	44.0	48.7	58.6	63.6	68.5	75.4	75.1	72.2	63.3	57.3	47.1	59.6
Bakersfield	45.8	49.2	56.7	65.3	75.4	81.6	90.5	87.1	78.5	65.8	56.2	48.0	66.7

Barstow	42.4	47.6	55.2	63.2	71.0	75.6	87.3	82.7	76.0	63.4	53.2	48.8	63.9
Beaumont	38.1	47.7	52.8	59.8	64.3	75.2	83.4	73.5	72.9	66.4	63.1	54.8	62.7
Belmont	44.6	48.4	51.2	56.0	66.6	67.2	71.6	68.9	64.7	62.6	54.8	48.4	58.8
Benicia Barracks	42.8	46.9	51.8	56.4	62.5	64.7	69.8	68.0	66.0	64.6	55.4	43.6	57.7
Berendo	43.4	49.1	54.7	62.2	71.9	76.2	83.9	83.0	76.2	66.9	53.8	46.0	63.9
Berkeley	43.7	46.1	50.7	52.5	57.5	58.8	60.1	60.3	59.2	59.8	56.8	48.1	54.5
Bishop Creek	31.8	41.4	53.3	[55.0]	74.4	87.0	89.6	81.3	73.2	59.5	55.0	40.1	[61.8]
Boca	19.2	27.2	33.4	[46.0]	52.5	[59.0]	63.6	62.1	63.6	48.9	43.8	26.9	[45.5]
Borden	42.4	47.1	56.7	62.2	69.3	76.3	79.9	80.0	76.2	66.0	54.5	48.9	63.3
Boulder Creek	43.7	46.0	53.7	58.3	64.0	63.7	71.1	66.5	60.1	54.8	47.9	44.4	56.2
Brentwood	48.6	53.7	61.9	70.1	69.8	[68.0]	89.5	80.5	70.6	68.2	55.8	45.8	[65.2]
Brighton	43.0	50.7	56.6	64.0	68.2	71.6	77.3	75.9	72.6	66.9	57.2	45.3	62.4
Byron	43.4	49.7	54.9	62.8	[65.0]	76.7	83.3	78.2	72.3	66.0	55.2	[45.0]	[62.7]
Caliente	44.4	48.2	49.2	58.9	73.6	77.0	85.7	79.3	74.7	63.3	53.6	46.9	62.9
Calistoga	41.9	43.5	50.0	54.7	[57.0]	69.1	72.0	67.8	65.1	60.0	54.1	48.1	[56.9]
Castroville	45.3	48.7	53.2	56.8	60.6	59.2	61.8	62.8	62.2	60.6	58.7	55.5	57.1
Centerville	48.3	52.1	57.9	62.9	66.4	67.0	70.1	e71.2	e68.0	e58.2	59.1	51.8	61.1
Chico	42.1	46.3	51.5	61.3	68.7	71.3	80.4	79.5	70.9	63.7	57.2	45.5	61.5
Cisco	25.4	29.9	33.2	37.3	43.3	51.5	62.5	63.9	57.4	45.6	44.7	32.2	43.9
Colfax	36.0	42.3	46.8	55.8	61.9	67.0	75.3	75.5	73.1	63.3	56.2	48.3	58.5
Colton	47.3	55.2	59.1	65.8	68.5	74.0	84.7	79.4	77.2	69.4	61.9	57.6	66.7
Corning	41.0	49.1	52.9	64.6	70.1	77.5	84.2	83.3	78.5	67.4	61.0	47.7	64.8
Davisville	45.2	50.7	54.0	59.7	66.1	68.1	75.1	[72.0]	70.7	64.9	59.6	48.9	[61.2]
Delano	46.2	49.6	56.1	65.2	73.1	78.2	87.4	84.5	79.9	66.6	57.9	47.9	66.0
Delta	35.8	41.6	47.8	59.5	66.6	70.3	75.9	75.1	67.8	59.7	55.5	48.4	58.7
Downey	50.1	57.2	62.9	68.2	66.5	69.8	75.4	74.2	71.3	69.7	63.5	[61.0]	[65.8]
Dunnigan	43.4	47.4	54.0	62.5	72.2	79.0	87.9	83.2	75.1	67.2	54.8	41.0	64.0
Dunsmuir	33.7	38.5	[32.2]	43.0	66.3	64.6	[78.1]	76.7	72.4	60.1	52.9	45.5	[52.0]
Edgewood	25.8	[35.0]	41.2	48.1	58.5	63.7	[71.0]	79.3	62.4	48.0	43.7	[37.0]	[51.1]
El Dorado	39.2	47.0	52.8	60.6	67.0	72.0	81.6	[74.0]	74.2	64.7	57.8	48.0	[61.6]
Elmira	45.8	51.5	54.9	62.4	70.0	71.6	77.1	74.1	69.2	68.2	58.0	47.1	62.5
El Verano	43.4	47.0	51.3	57.0	63.9	66.5	69.7	67.7	64.7	60.9	53.6	45.7	57.6
Emigrant Gap	28.4	33.3	34.0	41.4	51.2	56.6	66.8	67.4	60.6	52.5	48.8	36.1	48.1
Esparto	-------	-------	-------	-------	67.0	77.1	81.0	79.0	71.6	65.1	56.7	45.5	-------
Esperanza	41.8	47.7	53.8	61.4	-------	-------	-------	-------	-------	-------	-------	-------	-------
Eureka	42.2	44.4	46.9	49.0	54.0	55.2	56.7	55.8	53.2	51.6	50.0	48.4	50.6
Farmington	43.6	48.6	53.8	59.8	68.5	71.2	78.4	76.6	72.3	63.9	57.4	45.9	61.7
Felton	44.9	46.7	53.4	59.0	67.3	69.0	75.0	73.6	72.3	66.6	54.7	50.5	61.1

[1] U. S. post hospital. [2] Signal Service.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
California—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
Florence	55.0	54.3	61.8	65.5	65.2	69.8	74.1	72.3	70.3	61.1	61.6	59.2	64.2
Folsom	42.5	46.8	54.1	61.8	66.4	71.1	79.0	80.8	75.2	61.3	58.1	45.2	61.9
Fort Bidwell	18.9	29.1	36.4	47.8	58.1	58.6	68.9	68.7	61.2	[50.0]	[44.0]	[36.0]	[48.1]
Fort Gaston	38.2	42.7	48.8	55.6	63.3	64.8	68.6	71.3	65.5	55.8	44.6	42.3	55.1
Fort Mason	45.5	48.4	52.5	53.5	57.9	56.9	57.6	58.7	58.6	58.8	55.9	47.9	54.4
Fresno[1]	42.2	47.2	54.6	61.2	69.4	73.4	82.5	80.8	74.6	64.5	56.9	43.8	62.6
Fresno[2]	44.4	54.2	57.6	64.3	74.1	76.3	85.0	84.5	80.4	69.3	58.5	53.8	66.9
Fruto	41.6	48.3	52.9	62.3	71.2	[75.0]	84.6	81.2	71.3	64.0	58.5	45.8	[63.1]
Galt	45.9	48.0	[52.0]	[54.0]	63.5	75.5	79.3	76.1	70.6	63.2	55.3	47.2	[60.9]
Georgetown	33.6	40.4	45.5	54.2	59.4	63.4	74.0	73.0	69.2	59.6	56.0	47.4	56.3
Gilroy	43.8	47.7	54.1	58.3	63.7	65.2	68.7	66.2	65.8	61.2	54.1	48.2	58.1
Girard	34.1	41.9	45.8	53.3	60.8	64.5	78.0	76.1	71.8	59.4	58.5	44.3	57.4
Glen Ellen	43.2	47.4	52.0	57.8	62.7	65.5	[65.0]	65.6	62.5	59.5	53.2	45.1	[56.6]
Goshen	43.6	46.9	54.9	63.5	70.1	76.5	84.1	81.5	77.8	70.0	60.9	42.8	64.4
Haywards	42.1	45.0	49.8	53.5	61.5	61.6	64.8	65.4	61.7	56.5	57.4	45.5	55.4
Hollister	49.9	55.6	57.9	59.5	66.1	66.0	70.4	66.5	62.5	59.7	54.3	51.3	60.0
Hornbrook	27.4	36.6	44.8	[48.0]	62.7	62.9	74.4	72.1	67.0	52.8	43.7	37.4	[52.5]
Hydesville	39.4	43.4	44.2	50.2	56.7	56.3	56.8	59.2	56.4	53.1	50.3	47.2	51.1
Indio	50.6	60.8	63.8	75.5	83.7	88.3	95.3	90.9	88.9	78.3	68.5	64.2	75.7
Ione	41.1	44.1	49.5	53.9	65.1	68.6	75.1	73.7	72.7	59.4	51.7	45.6	58.4
Iowa Hill	34.9	40.8	45.9	55.4	62.9	67.1	76.4	75.9	72.2	61.7	58.2	48.6	58.3
Jolon	39.4	42.3	51.2	57.4	65.7	70.3	79.8	75.8	----	----	----	----	----
Julian	41.6	47.1	51.0	57.4	60.1	70.0	74.6	71.4	71.1	58.4	56.8	49.9	59.1
Keeler[1]	36.0	42.1	52.0	59.4	69.0	73.2	85.0	80.1	73.2	60.4	51.2	42.5	60.3
Keeler[2]	40.8	[42.0]	[52.0]	67.6	77.0	81.4	91.3	85.6	77.4	66.8	56.4	46.4	[65.4]
Keene	38.4	42.6	49.4	55.4	66.9	70.2	77.5	75.3	69.9	58.7	52.9	48.5	58.8
King City	41.5	44.8	50.6	56.2	64.1	64.1	68.5	68.6	67.0	65.2	55.0	47.9	57.8
Kingsburg	43.3	43.2	51.0	65.3	73.8	75.9	85.2	82.7	76.5	62.1	51.9	45.7	63.0
Knights Landing	48.4	52.9	57.3	60.8	66.9	70.5	75.8	74.7	70.6	63.4	51.6	49.9	61.9
La Grange	42.3	45.9	54.3	59.8	68.6	71.6	82.8	80.6	75.8	64.5	55.7	50.0	62.7
Lathrop	43.1	50.7	54.7	59.9	71.4	75.4	80.6	74.2	68.7	64.7	56.5	49.1	62.4
Laurel	43.3	47.9	54.1	58.3	62.8	65.2	70.0	69.8	66.3	63.5	57.0	48.7	58.9

Lemoore	44.1	55.0	57.2	64.5	71.1	76.1	83.5	80.4	74.1	64.5	53.7	46.0	64.2
Lewis Creek	42.0	47.0	54.8	62.6	71.4	g75.9	85.0	80.7	------	------	------	------	------
Livermore	42.8	49.0	52.9	55.4	57.5	61.0	69.9	71.9	70.2	65.5	56.8	52.9	58.8
Livingston	44.0	46.8	53.2	59.2	70.5	76.3	85.2	83.6	78.3	66.7	55.2	[47.0]	[63.8]
Lodi	42.9	48.5	54.1	58.8	64.4	67.0	73.4	72.4	70.1	64.0	55.1	45.3	58.8
Long Beach	54.5	55.0	[57.0]	62.2	[63.0]	69.9	69.9	71.7	68.7	65.0	61.9	57.4	[63.0]
Los Angeles[1]	49.1	54.2	57.5	59.4	63.2	67.6	73.2	72.8	71.4	67.8	66.2	61.2	63.6
Los Angeles[2]	48.0	53.4	58.9	61.9	67.1	71.5	76.1	74.7	73.6	66.7	64.1	60.2	64.7
Los Banos	40.7	46.5	54.1	[63.0]	[70.0]	[75.0]	84.4	85.3	76.0	68.2	54.5	46.3	[63.7]
Los Gatos[2]	45.1	49.9	54.5	62.7	66.8	68.0	71.3	70.3	66.9	65.3	56.0	49.8	60.6
Los Gatos[3]	44.2	48.4	53.2	56.8	63.4	63.5	[64.0]	67.7	65.6	61.6	55.5	46.6	[57.5]
Mammoth Tank	50.4	59.0	69.1	77.8	83.6	88.7	95.2	93.1	90.9	74.9	68.3	59.0	75.8
Martinez	42.6	45.7	52.0	55.8	63.9	70.7	76.3	68.4	61.1	62.7	51.7	43.0	57.8
Marysville[1]	47.6	47.2	55.8	66.1	70.2	69.9	80.1	81.0	73.4	[65.0]	[56.0]	50.9	[63.6]
Marysville[4]	41.4	46.7	53.0	60.7	66.1	69.6	75.9	75.6	73.0	63.0	53.4	43.9	60.4
Menlo Park	45.4	47.8	53.7	57.0	62.8	63.7	66.9	66.3	64.9	[62.0]	54.6	48.6	[57.8]
Merced	43.8	49.9	56.4	59.1	67.8	73.0	81.5	74.7	69.5	65.8	59.7	[47.0]	[62.4]
Modesto	39.9	44.1	50.2	51.6	69.3	74.3	80.9	78.9	72.9	67.3	55.3	47.6	61.9
Mojave	42.8	45.4	52.5	62.8	72.1	76.6	89.5	83.9	77.4	64.0	53.4	47.5	64.0
Morson	------	------	------	------	------	77.6	87.3	85.9	74.9	62.0	52.1	44.4	------
Montague	22.1	38.5	46.9	58.3	67.0	66.2	80.7	80.9	71.6	56.4	50.4	40.1	56.6
Monterey	48.7	47.9	51.7	52.1	57.4	58.6	59.9	61.0	59.2	58.7	54.6	52.5	55.2
Monterey (Hotel del Monte)	47.6	48.7	53.4	54.7	59.7	59.5	60.2	61.5	59.5	57.6	55.4	53.1	55.9
Mount Hamilton	30.2	36.8	40.5	47.6	54.5	57.6	67.4	68.9	65.9	58.1	55.5	45.7	51.8
Napa[2]	46.6	49.7	47.8	56.2	64.5	65.5	69.4	67.3	61.0	54.9	56.8	47.3	57.2
Napa[5]	39.4	43.8	48.9	53.9	59.9	62.2	63.9	63.1	61.1	58.4	51.7	41.0	54.0
National City	49.8	54.1	57.0	58.4	61.2	66.4	71.1	72.5	71.6	66.6	64.9	60.7	62.9
Newark	47.2	50.6	55.4	60.0	66.4	66.0	68.4	68.3	65.5	63.1	56.3	50.3	59.8
Newhall	44.3	50.7	53.8	57.0	62.3	65.9	80.0	76.4	70.8	63.0	57.4	53.8	61.3
Newman	45.6	48.1	53.6	59.9	70.8	76.2	[80.0]	89.2	79.3	70.5	55.5	48.0	[64.7]
Niles	48.9	52.7	54.3	58.9	65.2	70.9	71.2	69.1	64.8	60.8	56.0	56.5	60.8
North Hill Vineyard	42.4	47.6	53.1	59.3	67.7	73.5	81.8	77.7	72.6	66.5	58.2	44.0	62.0
Norwalk	48.8	53.1	58.9	63.9	67.4	73.5	73.4	74.9	73.1	71.5	64.4	60.5	65.3
Oakland[2]	45.2	49.2	53.0	55.3	61.2	60.7	61.7	60.3	59.0	58.5	53.3	53.2	55.9
Oakland[6]	44.4	47.7	54.3	54.9	59.7	59.5	61.6	62.2	61.2	61.8	57.2	49.5	56.2]
Ogilby	[50.0]	[58.0]	[64.0]	73.7	87.4	93.5	98.5	91.5	95.7	79.8	72.2	61.5	[77.2
Ontario	50.1	56.9	62.2	64.2	71.0	75.2	87.2	82.1	78.6	72.0	65.3	60.4	68.8
Orland	43.4	48.9	55.0	65.0	71.0	75.7	84.7	82.6	[74.0]	67.6	61.1	47.4	[64.7]

[1] Signal Service. [2] Pacific Railway System. [3] F. H. McCullagh. [4] Appeal Office. [5] W. H. Martin. [6] Chabot Observatory.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
California—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
Oroville	[40.0]	47.9	53.7	62.5	70.0	74.7	80.3	79.8	[71.0]	67.9	62.0	47.9	[63.1]
Pajaro	45.3	48.4	53.2	54.9	59.3	59.1	60.9	61.3	60.4	58.7	55.9	54.0	56.0
Pasadena	45.7	51.2	55.8	59.8	64.1	------	------	------	------	------	------	------	------
Paso Robles	40.4	44.0	50.5	58.1	65.8	68.9	74.5	70.3	67.6	58.8	50.0	46.2	57.9
Petaluma	45.0	48.7	53.3	56.2	67.3	64.3	67.9	66.4	64.2	64.7	53.8	46.2	58.2
Placerville [1]	37.2	43.2	49.1	49.3	59.9	68.4	75.8	72.8	68.6	60.8	49.1	45.5	56.6
Placerville [2]	37.6	42.2	43.2	49.3	64.9	62.8	70.0	70.0	66.5	55.7	48.4	42.5	54.4
Pleasanton	46.6	50.7	[52.0]	52.0	56.1	66.0	70.7	67.5	67.7	58.8	50.6	46.0	[57.1]
Point Reyes Light	45.5	48.1	49.2	49.2	53.4	53.0	53.2	55.6	[55.0]	[56.0]	[54.0]	*m*51.8	[52.0]
Pomona	44.0	49.7	51.7	62.0	66.4	68.5	77.8	75.1	74.2	69.8	64.6	59.8	63.6
Portersville	46.3	48.2	58.4	62.9	77.7	80.9	89.7	85.0	79.9	59.0	52.4	47.9	65.7
Presidio of San Francisco	46.3	47.7	51.4	52.0	56.8	55.5	56.8	57.6	58.6	60.9	57.8	50.4	54.3
Puente	46.3	52.0	55.5	62.8	66.1	72.3	78.1	76.2	73.3	66.6	62.6	57.4	64.1
Ravenna	------	------	------	------	------	68.5	88.6	78.1	75.0	63.9	58.4	52.8	------
Red Bluff [1]	42.7	49.4	54.7	62.6	68.9	67.0	81.0	82.2	76.1	66.9	60.8	51.0	63.6
Red Bluff [3]	39.2	45.0	50.8	60.3	67.8	72.6	80.4	79.7	74.3	65.0	58.0	45.0	61.5
Redding	39.4	46.2	53.9	63.7	65.7	71.3	78.7	83.9	76.7	64.1	58.1	48.1	62.5
Riverside	43.0	50.2	52.5	58.0	62.5	67.1	76.1	75.8	69.6	63.0	57.7	54.0	60.8
Rocklin	44.4	49.3	53.9	62.0	68.6	73.2	80.4	79.8	73.7	64.9	56.0	46.5	62.7
Rumsey	42.6	47.0	53.1	62.7	71.5	81.3	85.5	82.7	74.2	67.0	60.5	46.4	64.5
Sacramento [1]	43.6	48.4	53.5	60.0	66.7	70.3	75.2	73.1	69.5	61.4	52.9	45.4	60.0
Sacramento [3]	42.6	47.4	52.6	59.0	65.4	67.8	73.8	72.8	70.4	63.4	54.8	43.2	59.4
Sacramento [4]	38.4	43.3	49.3	55.3	62.0	64.4	68.4	66.8	62.2	53.9	44.9	39.9	54.1
Salinas [1]	43.9	46.2	51.7	55.7	57.5	58.8	63.1	60.4	60.8	59.9	50.8	49.3	54.8
Salinas [5]	45.2	*d*46.7	51.0	52.6	57.2	57.4	58.2	59.8	59.2	*g*57.3	*d*52.8	*f*49.0	53.9
Salton	50.4	57.3	65.4	73.4	81.7	88.6	97.2	89.3	87.9	72.6	62.7	58.2	73.7
San Ardo	43.5	46.7	53.3	57.3	64.1	68.7	73.8	73.1	61.8	65.6	55.4	48.6	59.3
San Diego	51.0	54.3	56.4	58.6	60.4	64.1	68.5	69.8	69.1	64.6	63.8	60.8	61.8
San Diego Barracks	51.2	54.7	56.4	60.2	62.5	66.0	70.8	71.0	70.2	65.5	62.8	60.5	62.6
San Fernando	44.5	52.5	60.0	61.9	64.6	73.8	81.5	78.0	72.7	67.0	61.5	55.9	64.5
San Francisco	46.2	49.1	53.8	54.8	59.8	59.2	59.8	61.4	60.4	62.4	59.0	49.8	56.3
San Gabriel	46.5	51.8	58.2	62.5	68.3	76.5	79.2	75.9	74.3	61.5	62.4	58.1	64.6

Sanger Junction	46.5	50.0	57.3	66.8	75.8	81.2	88.8	87.2	80.0	67.6	58.0	46.0	67.1
Jan Josó	45.0	48.7	53.9	56.7	63.5	63.6	65.9	66.8	64.9	60.5	55.1	48.6	57.8
San Mateo	44.1	44.7	49.1	53.6	60.7	59.3	60.4	65.3	61.8	57.2	55.6	47.1	54.9
San Miguel	45.4	46.7	53.8	57.9	63.7	66.1	72.0	71.6	66.6	67.3	53.3	[49.0]	[69.4]
San Pedro	50.1	54.9	57.8	61.2	64.7	68.2	73.9	74.7	73.4	68.6	66.2	62.1	64.6
Santa Ana	48.5	55.3	57.2	63.1	67.0	70.7	77.2	76.1	77.1	71.6	63.4	60.4	65.6
Santa Barbara[6]	48.4	52.6	55.6	56.6	60.0	62.4	67.3	67.9	66.5	64.0	63.3	58.4	60.2
Santa Barbara[1]	49.2	52.4	57.4	65.0	65.1	69.7	70.9	73.5	68.8	65.4	58.7	55.3	62.6
Santa Clara	45.6	49.4	53.5	56.0	61.4	60.8	64.2	65.7	63.6	61.0	54.8	47.5	57.0
Santa Cruz[1]	49.6	52.0	54.5	58.1	62.6	61.9	69.5	68.3	68.1	61.2	57.0	53.1	59.7
Santa Cruz[6]						64.3	62.8	62.9	61.0	59.0	55.3	51.5	
Santa Margarita	38.8	38.6	51.7	56.2	64.7	63.1	69.8	64.7	60.7	55.8	46.5	42.5	54.4
Santa Maria	45.6	51.4	54.7	57.0	61.7	*f*59.8	*e*62.8	*g*65.6	63.5	61.8	58.3	53.2	58.0
Santa Monica	53.2	54.2	60.3	61.3	67.0	69.7	70.0	71.4	69.9	64.3	59.0	58.6	63.2
Santa Paula	49.2	55.6	61.2	[62.0]	68.1	73.9	75.7	74.0	69.9	67.9	67.9	64.0	[65.8]
Santa Rosa	43.3	46.9	49.6	54.7	60.6	65.0	66.5	63.9	62.8	61.3	53.7	46.6	56.2
Selma	42.5	48.2	54.6	65.2	81.7	72.9	82.1	81.9	75.8	62.1	54.2	44.2	63.8
Seven Palms	55.5	60.3	68.4	78.1	81.7	89.0	101.4	91.3	72.3	69.0	62.7	59.9	74.1
Shingle Springs	35.8	39.6	51.3	[55.0]	57.8	75.6	79.7	77.7	73.9	61.3	55.9	49.0	[59.4]
Sims	33.8	38.1	42.8	53.1	63.0	65.5	72.2	74.7	69.3	54.4	48.5	42.7	54.8
Sisson	[30.0]	34.7	36.8	47.6	61.4	[70.0]	70.1	69.1	61.4	46.2	41.4	35.4	[50.3]
Soledad	42.8	46.8	52.2	55.3	61.3	63.1	64.9	65.5	63.3	60.0	54.6	50.3	56.7
Sonoma	*e*50.0	49.0	52.4	55.8	*d*61.2	63.2	63.1	66.4	*h*66.2	60.8	56.6	*h*45.8	57.5
Soquel	49.2	51.4	57.0	59.7	64.8	66.5	66.8	66.7	63.6	59.7	57.3	55.2	59.8
South Side	39.8	51.2	53.2	57.9	62.4								
South Vallejo	[43.0]	45.5	50.1	[55.0]	58.6	52.5	64.4	62.2	59.8	64.6	54.7	40.3	[54.2]
Spadra	46.1	51.5	56.7	70.8	69.6	73.0	74.4	74.3	71.9	66.5	60.4	56.6	64.3
Steeles	45.7	50.0	54.2	56.8	60.6	60.3	64.4	65.7	63.8	64.1	59.4	55.0	58.3
Stockton	46.2	50.2	51.6	59.3	67.8	70.9	74.1	[76.0]	56.3	[64.0]	63.9	[45.0]	[60.4]
Suisun City	44.6	48.5	53.5	59.7	65.8	66.3	72.0	70.2	68.0	65.4	55.9	47.9	59.8
Summit	24.6	28.2	33.6	34.9	[37.0]	39.7	61.5	61.8	61.8	45.9	39.8	29.5	[41.5]
Susanville	23.9	29.0	36.2	48.2	60.1	61.8	75.5	75.7	67.8	55.0	44.2	34.2	51.0
Tehachapi	32.8	35.1	44.5	51.3	59.6	66.6	78.1	74.4	65.7	54.7	47.8	34.2	51.0
Tehama	40.2	49.3	56.5	70.1	71.1	72.9	84.9	79.4	75.7	62.5	58.3	41.9	54.4
Templeton	43.3	47.2	53.6	58.6	63.9	69.1	73.9	64.9	68.3	61.1	51.8	51.6	64.4
Towles	30.7	36.7	41.9	51.6	60.3	65.9	73.3	71.2	67.7	56.3	51.0	48.0	58.6
Tracy	42.5	40.2	49.6	56.2	69.0	73.0	81.2	73.6	69.5	[64.0]	46.3	42.6	54.1
Traver	42.5	50.8	53.5	34.0	73.2	80.5	84.6	78.1	72.8	64.6	56.5	44.3	[59.1]

[1] Pacific Railway system. [2] R. Rowland. [3] Signal Service. [4] S. H. Gerrish [5] Dr. E. K. Abbott. [6] Hugh D. Vail.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
California—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
Tropico	47.3	50.9	55.1	61.4	68.2	71.4	80.5	74.8	71.0	68.1	63.1	54.4	63.8
Truckee	21.7	25.1	30.8	38.8	47.2	56.4	71.3	64.9	56.6	47.1	37.0	26.7	43.6
Tulare	45.5	50.6	57.4	66.2	74.4	78.5	86.4	84.9	78.6	66.4	57.9	47.3	66.2
Turlock	45.6	50.1	55.9	62.5	70.6	75.4	82.3	80.4	74.0	63.3	54.0	47.2	63.4
Upper Mattole	43.8	47.5	52.6	57.2	63.6	61.0	65.9	66.3	62.1	59.2	53.0	51.1	56.9
Vacaville[1]	42.8	47.7	52.2	58.3	65.9	70.4	76.9	74.7	72.6	65.4	56.7	44.7	60.7
Vacaville[2]	42.1	46.6	53.0	60.0	67.7	71.9	78.1	75.1	71.1	66.8	57.6	44.8	61.2
Valley Springs	40.1	44.8	50.8	59.9	66.0	71.9	79.6	76.8	71.5	63.8	56.2	41.7	60.3
Vina	41.7	46.5	53.0	63.2	70.9	76.8	83.9	83.0	75.9	64.6	57.7	44.1	63.4
Volcano Springs	52.7	58.7	69.1	79.2	88.9	95.7	102.4	95.3	88.7	71.2	64.1	60.1	77.2
Volta	44.4	48.0	54.9	63.3	70.2	76.8	81.8	79.6	75.1	65.5	54.0	a45.6	63.3
Walla Walla Creek	25.9	31.7	32.2	47.2	58.4	59.8	67.4	68.0	64.3	50.3	44.6	36.2	48.8
Walnut Creek	44.2	47.8	49.8	57.9	62.5	66.0	72.6	71.9	68.0	64.0	55.7	46.8	58.9
Westley	47.0	50.3	58.2	64.2	74.0	77.3	83.8	82.0	77.4	70.3	56.4	50.0	65.8
Wheatland	41.0	45.6	51.0	58.5	65.4	69.4	76.2	75.4	71.6	63.6	53.8	42.2	59.5
Whittier	52.0	61.4	51.2	65.2	67.0	70.3	74.8	74.4	75.3	71.8	66.5	62.2	66.2
Williams	37.8	41.8	50.1	63.1	71.7	74.8	81.0	82.5	73.8	58.8	48.6	43.0	60.6
Willows[3]	41.1	46.6	51.6	57.7	66.2	71.5	77.2	m72.3	72.0	62.8	55.4	43.7	59.8
Willows[2]	42.2	47.4	49.9	58.4	69.3	69.6	70.5	73.5	68.5	64.3	56.6	43.2	59.4
Winters	44.0	50.1	56.0	64.8	74.3	80.4	85.7	84.7	76.8	67.7	57.6	46.9	65.8
Woodland	41.2	45.6	50.9	59.4	63.8	70.7	75.6	73.4	68.3	64.9	56.7	50.6	60.1
Colorado:													
Agate	29.0	26.4	40.9	37.0	53.9	77.0	83.4	[73.0]	[58.0]	56.0	45.8	e41.0	[51.8]
Alma	[19.0]	[20.0]	21.6	30.2	39.1	49.9	55.0	52.3	44.9	33.1	25.9	24.2	[34.6]
Apishapa	27.5	33.6	36.5	47.6	59.0	68.5	72.8	74.6	71.5	62.0	56.0	[36.0]	[53.8]
Bennett	35.2	23.7	30.2	36.2	44:3	57.4	77.0	74.9	56.6	36.0	32.0	44.4	45.7
Breckenridge	22.7	27.1	21.2	32.2	41.2	47.6	55.0	53.0	45.2	35.0	30.8	26.9	36.5
Byers	27.5	30.6	39.7	53.2	62.4	83.5	82.5	71.8	66.0	50.4	42.8	33.0	53.6
Cañon City	33.4	36.8	43.6	52.0	63.0	70.6	75.2	72.2	63.9	[49.0]	45.9	42.6	[54.0]
Castle Rock	[28.0]	[29.0]	37.4	47.4	54.8	64.0	71.8	70.4	60.5	47.6	38.9	[37.0]	[48.8]
Cheyenne Wells	27.5	32.9	34.7	50.8	59.0	70.2	78.4	- - -	- - -	- - -	- - -	- - -	- - -
Climax	11.4	13.0	17.4	25.9	36.0	44.8	52.6	48.9	41.9	28.6	23.2	22.0	30.5

Colorado Springs	28.0	32.3	38.6	47.5	55.2	65.1	72.0	67.2	59.7	49.4	40.4	[36.0]	[49.3]
Cumbres				n29.6	43.6	50.4	54.5	52.1	46.9	35.3		21.2	
Como (ranch near)	15.2	[20.0]	24.3	32.4	42.4	49.9	53.6	51.4	44.5	33.1	[24.0]	22.0	[34.4]
Deer Trail	23.3	24.9	33.9	41.6	52.6	65.8	75.0	[72.0]	52.5	45.4	39.6	35.0	[46.8]
Delta	28.0	34.6	40.4	47.0	59.7	e69.4	e76.5	71.3	62.2	45.6	37.0	32.2	50.3
Denver	28.2	34.0	41.0	48.0	57.7	67.6	74.8	69 0	62.5	49.4	40.3	39.3	51.0
Denver (Jesuit College)	27.9	32.2	40.7	46.4	58.4								
First View	28.5	30.7	41.8	51.0	60.8	73.0	79.6	72.4	62.9	[52.0]	41.4	31.0	[52.8]
Fort Collins	24.7	30.0	38.0	46.5	56.1	64.1	71.2	66.0	58.3	47.4	38.1	34.0	47.9
Fort Crawford	27.6	30.6	34.8	45.3	55.4	61.8	70.0	66.0	g56.8	[46.0]	[37.0]	[32.0]	[46.9]
Fort Lewis	20.4	27.9	33.3	41.6	51.6	55.8	72.2	64.2	55.3	44.2	36.6	28.9	44.3
Fort Logan	28.6	33.3	40.2	48.7	57.8	66.8	73.4	69.2	62.6	50.2	41.7	40.2	51.1
Fraser	7.2	12.8	19.4	31.0									
Fruita	20.8	33.4	40.8	53.9	66.6	72.2	81.9	75.0	64.2	46.4	35.1	30.7	51.7
Georgetown	26.2	28.2	32.6	39.2	49.4	58.5	62.5	58.8	52.7	41.8	35.6	33.0	43.2
Greeley	22.8	25.8	34.4	46.7	55.6	66.4							
Greenhorn						65.6	69.7	66.8	57.8	45.4	35.4	40.0	
Gunnison	4.5	20.6	29.8	38.8	49.1	52.7			53.0				
Hugo	29.3	40.0	42.6	50.8	59.8	70.2	78.4	73.5	59.4	51.4	38.9	33.7	52.3
Husted	28.1	32.4	39.1	45.8	54.5	64.2	71.2	66.2	58.6	47.2	37.6	34.4	48.3
Idaho Springs	26.5	33.2			51.9	58.0						33.7	
Julesburg				52.8	60.2	70.9	79.4	75.0	61.8		37.9	34.8	
Kit Carson	26.6	37.1	43.5	52.4	65.6	73.6	80.3	78.4	57.6	52.4	51.2	50.8	55.8
Lamar	33.0	35.0	45.0	52.0	63.8	74.5	82.6	76.7	66.7	53.4	44.6	34.9	55.2
Las Animas	30.0	34.2	42.8	51.7	62.6	72.2	79.1	74.2	65.1	51.4	40.8	37.6	53.5
Leadville	14.8	17.2	21.8	26.8	33.8	43.8	[54.0]	52.2	45.7	32.1	28.0	24.1	[32.9]
Le Roy	[18.0]	[20.0]	39.9	48.5	59.7	65.1	89.8	70.8	62.7	48.0	36.0	32.9	[49.3]
Longmont	g24.1			49.0		68.0	75.8	b69.4	62.4	b50.0	c40.1	i37.0	
Magnolia	27.4	29.1	33.2	41.7	52.8	66.4	71.6	69.5	66.7	46.0	[42.0]	[39.0]	[48.8]
Monte Vista	18.0	27.4	33.4	41.4	54.8	61.0	66.5	63.0	54.8	41.0	32.0	23.3	43.0
Montrose	26.6	34.2	39.8	49.4	59.6	66.0	74.2	69.3	61.3	46.7	37.4	31.8	49.7
Moraine	27.7	26.1	31.2	41.2	[56.0]	54.4	62.4	58.4	51.6	41.7	36.6	32.2	[43.0]
Pagosa Springs								64.6	53.7	39.6	30.8	24.3	
Palmer	28.4	29.6	36.0	43.4	52.1								
Pueblo	31.2	34.6	43.4	50.5	59.4	69.2	76.5	72.0	63.6	50.6	41.0	36.8	52.4
River Bend	30.2	33.5	54.9	46.3	57.4	72.1	80.8	69.5	64.1	[50.0]	42.2	35.6	[53.0]
Rocky Ford	21.4	29.8	38.9	48.8	60.4	71.1	77.3	73.2	63.2	50.8	40.9	35.8	51.0

[1] G. O. Colburn. [2] Pacific Railway system. [3] A. W. Sehorn.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Colorado—Continued.													
San Luis experiment station	21.1	30.2	36.4	42.8	52.8	58.2	65.6	62.8	55.0	43.6	33.4	25.6	44.0
Sterling						70.2	77.9	d72.2	64.4	55.7			
Thon	27.4	30.2	37.4	46.8	54.0	62.8	72.0	68.0	59.6	49.0	40.2	38.2	48.8
T. S. Ranch	27.8	34.1	39.3	51.3	62.6	68.8	77.4	d72.2	d63.9	49.4	39.4	32.5	51.6
Watkins	29.7	31.8	40.6	49.7	59.9	72.3	81.4	70.6	66.3	47.7	31.3	26.6	50.7
Westcliffe	27.3	29.0	34.2	40.1	47.3	59.8	61.5	57.4	50.6	42.7	30.9	26.3	42.1
Connecticut:													
Canton	[33.0]	[35.0]	32.3	45.8	57.7	67.8	69.2	67.2	59.8	48.4	39.8	21.6	[48.1]
Colchester	34.0	33.0	32.3	46.4	56.6	65.1	68.8	68.5	62.3	49.4	40.1	26.7	48.6
Fort Trumbull	37.4	36.7	36.2	47.5	57.7	67.4	72.5	72.0	67.4	53.1	44.7	29.5	51.8
Hartford	32.8	35.2	33.4	45.1	55.9	67.6	71.6	70.9	61.2	49.4	39.8	23.5	48.9
Mansfield	32.0	31.4	30.8	44.7	54.9	63.3	67.5	66.0	59.5	47.6	37.9	23.4	46.6
Meriden	34.0	25.2	27.0	42.8									
Middletown	33.7	34.2	32.7	46.9	57.1	65.9	69.0	67.8	61.1	49.1	39.5	24.7	48.5
New Hartford	23.6	23.3	22.2	38.5	54.2	62.7	66.2	65.0	58.6	43.9	32.5	18.2	42.4
New Haven	35.4	35.5	34.2	47.0	56.8	65.9	69.4	69.1	62.8	51.3	41.7	26.6	49.6
New London	36.6	36.8	36.1	47.2	56.3	65.3	69.7	69.6	64.2	52.0	43.2	29.4	50.5
Shelton	34.0	34.5	31.9	45.6	56.8	66.0	70.2	[69.0]	60.9	48.4	38.9	[26.0]	[48.1]
Southington	33.3	33.6	32.2	46.5	57.2	66.2	69.4	67.9	60.5	48.6	38.1	23.9	48.1
Thompson	30.2	30.1	[31.0]	45.9	55.6	62.7	68.1	65.8	59.8	47.3	37.4	22.7	[46.4]
Voluntown	35.0	34.8	35.4	46.0	55.8	63.8	69.0	e67.0	61.3	g49.4	40.3	26.8	48.7
Waterbury	31.8	33.7	31.6	45.7	57.2	66.4	70.0	69.1	61.8	49.6	37.4	22.4	48.1
Delaware:													
Kirkwood	37.9	37.8	36.2	51.2	62.6	74.3	75.4	74.4	70.5	57.5	43.2	30.4	54.3
District of Columbia:													
Kendall Green		41.2	40.9							55.5	47.5		
Washington	43.8	43.4	41.4	53.6	63.8	74.8	75.0	73.6	67.8	56.4	48.0	34.2	56.3
Washington Barracks	44.0	32.5	41.7	42.0	63.4	74.8	d76.8	75.5	69.5	57.4	48.2	35.5	55.9
Florida:													
Altamonte Springs	67.0	68.0	66.0	71.6	76.2	81.4	81.2						
Alva	66.6	66.9	65.1	71.9	75.8	78.7	79.8	77.9	78.1	73.8	69.0	59.6	71.9

Archer	65.3	65.4	61.7	70.6	75.1	82.2	81.8	81.6	80.0	72.0	65.7	56.2	71.5
Fort Barrancas	63.8	63.7	59.8	69.2	73.1	81.5	75.4	81.0	78.6	68.9	66.5	57.4	69.9
Fort Mead	62.4	68.8	59.7	72.8	72.8	76.0	77.4	79.0	77.4	73.4	68.8	59.4	70.7
Homeland	67.6	69.6	65.5	73.4	78.2	81.6	81.3	80.6	79.4	74.7	70.1	60.4	76.9
Hypoluxo	[70.0]	70.0	68.0	72.4	75.5	81.2	81.0	80.0	78.4	74.9	72.8	64.1	[74.0]
Jacksonville	63.4	64.8	60.2	69.8	74.4	81.8	81.0	80.4	79.1	71.3	65.6	55.9	70.6
Jupiter	72.2	70.2	67.8	73.2	76.0	80.4	80.8	80.4	79.0	75.6	73.7	64.7	74.5
Key West	73.4	73.3	70.6	75.2	78.8	81.4	82.2	81.8	80.3	79.6	74.8	68.2	76.6
Lake City	65.1	65.5	61.5	------	72.8	80.8	80.2	80.9	------	------	------	------	------
Madison	62.7	61.9	60.8	69.7	73.9	80.0	80.9	80.4	77.0	70.6	63.7	[52.0]	[69.5]
Manatee	68.0	67.5	64.4	70.9	76.8	81.8	80.7	80.3	78.7	74.3	69.2	[60.0]	[72.7]
Matanzas	64.8	66.0	62.1	70.8	73.7	79.3	------	------	------	------	------	------	------
Merritts Island	69.6	68.3	62.9	73.4	76.6	83.4	81.3	81.6	78.0	75.5	71.3	61.2	73.6
Micco	d67.1	a67.8	l64.2	g72.9	c76.0	n80.7	[80.0]	n82.4	[79.0]	g73.9	d68.6	k61.0	[70.3]
Ocala	63.4	64.3	61.1	n71.4	------	------	------	------	------	------	------	g54.4	------
Pensacola	62.8	63.0	58.8	68.4	72.8	79.6	80.1	80.0	76.9	68.1	62.8	54.5	69.0
Pine Level	70.2	68.0	66.0	71.2	75.5	77.6	78.6	80.2	77.8	74.6	[68.0]	[59.0]	[72.2[
St. Francis Barracks	64.6	65.5	62.6	e70.8	[74.0]	l80.6	79.8	78.8	77.6	71.4	65.9	56.9	[70.7]
San Antonio	64.8	64.4	62.1	69.2	72.8	79.9	79.6	76.5	77.4	70.7	69.7	60.4	70.6
Tallahassee	60.1	61.1	57.5	69.2	72.8	79.6	80.8	77.6	74.0	66.8	61.2	51.7	67.7
Tampa	[65.0]	[68.0]	[68.0]	a72.0	76.5	80.8	80.2	80.6	79.5	74.2	69.2	60.6	[72.9
Titusville	66.4	66.6	62.8	70.1	74.8	79.5	80.0	80.2	78.8	74.2	69.0	60.4	71.9
Villa City	66.9	67.5	63.5	71.5	75.6	79.3	79.5	81.0	79.1	73.2	64.9	52.1	71.2]
Georgia:													
Albany	------	------	------	------	74.0	d83.0	82.0	80.4	77.8	67.5	61.1	------	------
Allapaha	60.5	54.7	[58.0]	[64.0]	72.8	80.9	80.1	77.5	77.0	66.6	60.2	[53.0]	[67.1]
Andersonville	63.5	e72.4	g72.2	67.9	70.3	78.8	78.5	------	------	------	------	------	------
Athens [1]	51.4	54.7	50.4	62.6	69.3	79.1	78.0	75.6	71.0	59.2	55.9	45.3	62.7
Athens [2]	51.3	55.6	52.3	63.8	72.2	83.2	78.4	75.0	71.6	59.8	54.6	45.1	63.5
Atlanta	51.0	54.8	49.6	62.2	69.0	78.8	78.2	75.2	71.6	59.6	57.6	45.4	62.8
Augusta	55.6	58.2	55.2	65.0	72.9	83.2	81.0	79.3	75.1	64.3	58.8	48.6	66.4
Bainbridge	------	------	------	------	73.8	80.4	81.9	77.8	68.8	67.1	61.3	------	------
Blakely	------	------	------	------	------	------	80.2	81.0	78.8	71.6	58.0	53.4	------
Camak	------	------	------	------	71.2	80.9	80.5	77.6	73.7	62.4	57.8	------	------
Cartersville	------	------	------	------	69.2	79.8	80.1	76.4	73.2	59.6	54.5	------	------
Columbus	------	------	------	------	70.6	79.2	78.8	77.8	74.5	62.8	55.8	------	------
Diamond	50.7	52.5	45.6	59.7	64.8	72.9	73.7	70.6	68.2	55.2	50.4	40.6	58.7
Eastman	------	------	------	------	73.4	83.4	81.2	79.1	75.3	65.9	60.6	------	------

[1] Prof. L. H. Charbonnier.

[2] Cotton Belt Observer.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Georgia—Continued.													
Forsyth	55.9	59.6	55.4	66.7	71.9	81.4	80.2	78.5	75.1	64.7	61.7	51.6	66.9
Fort Gaines					72.8	81.6	81.0	79.4	76.4	65.6	59.2		
Fort McPherson	52.0	55.3	37.4	62.4	68.5	78.9	78.6	75.0	72.0	[60.0]	57.7	43.8	[61.8]
Gainesville					67.6	76.0	76.1	72.8	69.4	56.6	52.6		
Gillsville	53.2	56.0	52.3	64.2	71.2	80.8	79.9	77.7	[71.0]	[59.0]	57.6	.7.1	[64.2]
Griffin					71.4	81.0	80.3	76.5	72.9	61.6	57.4		
Hephzibah	56.2	60.6	58.0	64.9	71.6	79.9	78.5	77.0	73.8	[64.0]	62.8	50.8	[66.5]
Louisville	[56.0]	59.6	55.8	65.7	72.4	81.5	80.8	e80.0	74.9	65.0	[59.0]	[48.0]	[66.6]
Macon					71.8	80.5	82.1	79.8	76.2	68.4			
Marietta	49.9	52.5	47.9	60.4	67.3	76.5	76.3	72.5	69.5	57.4	53.4	43.3	60.6
Milledgeville	53.5	56.7	53.7	64.0	70.2	80.6	80.0	77.9	73.6	64.3	57.8	47.8	65.0
Millen	55.0	58.8	54.3	65.2	74.0	83.4	80.4	79.2	76.2	64.4	58.9	[48.0]	[66.5]
Monticello	51.1	54.0	50.5	63.2	70.0	77.8	78.4	75.8	72.1	59.4	55.0	44.6	62.5
Newnan					65.4	75.0	78.4	70.0	71.9	59.8	56.6		
Perry	[56.0]	57.9	53.8	65.0	72.6	80.8	80.2	78.8	75.4	63.4	56.5	42.3	[65.2]
Point Peter	50.4	52.2	49.2	61.9	66.0	78.6	78.4	74.6	70.4	56.0	53.4	42.3	61.1
Poulan									74.9	65.0	58.4	50.1	
Quitman[1]	60.5	62.5	57.9	69.8	73.6					67.7	61.4	53.4	
Quitman[2]					74.2	81.8	82.8	81.2	78.6	68.8	62.9		
Savannah	59.8	61.2	56.6	66.5	73.0	80.9	79.5	78.6	75.4	67.0	61.5	51.8	67.6
Thomasville[1]	61.0	61.9	57.8	68.4	72.2	[80.0]	80.2	80.2	77.6	69.1	[63.0]	[53.0]	[68.7]
Thomasville[2]					72.6	80.4	80.6		77.6	68.4	63.2		
Toccoa					67.3	77.8	78.0	75.2	71.6	57.6			
Union Point					69.7	79.8	79.6	77.6	73.1	61.8	56.4		
Washington					70.4	80.6	80.4	76.8	73.8	60.2	56.7		
Way Cross					74.6	81.6	81.4	79.8	76.8	72.4	68.6		
Waynesboro					70.8		80.9	79.6	74.7	64.8	59.2		
West Point					73.0	82.6	82.7	80.4	76.6	64.8	59.2		
Wolleys Ford	49.0	50.6	46.4	59.2	65.6	76.8	[76.0]	74.0	68.5	55.4	51.7	41.5	[59.6]
Idaho:													
American Falls					58.1	60.6	71.4	67.0	57.0	42.2	31.6	26.6	
Boisé Barracks	21.5	33.9	41.3	50.8	60.2	62.9	73.9	70.5	56.0	47.1	37.7	33.0	49.1

Boisé City	22.8	34.2	41.2	51.8	60.2	62.6							
Bonanza				o37.6	45.3	48.0	59.0	56.3	47.6		27.6	19.2	
Era	11.9	22.6	28.4	41.3	53.3	53.1	65.0	61.0	55.2	41.4	33.8	23.6	40.9
Fort Sherman	18.8	26.0	36.4	46.2	57.8	60.6	67.1	65.8	57.8	47.3	42.6	37.9	47.0
Henrys Lake						55.0		54.8	51.8	37.0	29.2	23.1	
Kootenai	16.1	21.4	34.9	46.4	56.9	59.9	65.8	66.2	54.2	43.0	34.1	33.9	44.4
Lewiston	25.3	32.7	44.0	53.8	64.0	65.5	78.0	74.2	63.6	46.5	37.7	40.0	52.1
Mullan	18.9	24.0	33.1	40.2	50.5	51.6	62.0	59.4	51.0	40.6	33.9	33.3	41.5
Payette	[20.0]	[32.0]	[40.0]	52.6	61.6	64.5	77.0	73.0	58.5	46.4	36.8	34.8	[49.8]
Soda Springs	12.4	21.2	24.5	39.0	51.6	54.1	64.6						
Illinois:													
Atwood	31.9	33.4						69.8		54.0			
Aurora[4]	27.9	30.6	28.4	47.6	54.4	71.6	71.2	65.0	58.3	49.8	38.4	26.3	47.5
Aurora[5]	29.6	31.4	29.3	49.8	55.2	73.8	[71.0]	65.8	60.5	50.7	40.4	29.1	[48.9]
Beason	32.8	34.5	32.2	52.8	57.4	74.3	72.9	68.1	60.6	d52.2	41.5	31.4	50.9
Belvidere	26.8	30.4	26.5	46.8	54.5	70.7	71.7	66.6	57.6	48.9	38.5	27.1	47.2
Cairo	44.6	44.6	42.9	59.2	66.0	79.4	79.0	75.0	66.5	58.0	51.0	40.0	58.8
Centralia	40.0	40.0	[38.0]	56.0	[63.0]	[78.0]	80.0	77.0	63.0	55.0	45.5	37.0	[56.0]
Charleston	[34.0]	36.4	35.2	54.4	61.2	77.5	75.7	70.6	61.7	54.4	45.6	31.9	[51.6]
Chicago	30.8	32.4	29.5	45.6	53.4	70.2	72.1	67.6	60.4	51.4	41.9	30.6	48.8
Cockrell	[23.0]	29.6	29.0	52.6	59.2	75.4	76.0	70.6	60.2	51.6	39.7	27.0	[49.5]
Collinsville	38.7	39.6	37.6	56.2	62.6	77.8	78.1	73.4	64.2	56.0	47.0	34.7	55.5
Dwight	31.7	34.6	32.0	51.6	58.5	75.8	76.1	72.0	62.8	[51.0]	[41.0]	[28.0]	[51.3]
East Peoria	35.4	37.1	35.8	56.7	61.9	78.5	78.2	73.9	67.0	56.9	47.2	34.1	55.2
Flora	39.5	40.5	38.0	56.5		78.5	76.0						
Fort Sheridan	29.3	32.6	29.6	45.5	55.0	69.4	70.5	67.6	f57.0	49.8	42.0	33.4	48.5
Golconda	43.2	44.0	41.5	58.6	65.6	79.4	80.6	75.5	66.8	57.4	49.8	37.8	58.4
Greenville	37.4	37.7	36.7	55.5	62.6	77.6	76.3	72.4	63.0	54.5	45.9	33.2	54.4
Griggsville	31.8	33.4	35.1	54.8	61.0	74.8	78.2	70.7	61.6	51.8	41.8	33.4	52.4
Hennepin	25.6	32.2	24.5	[53.0]	54.6	73.5	73.7	68.8	60.6	50.8	39.7	28.4	[48.8]
Jordans Grove	39.5	38.7	38.0	56.2	63.7	78.0	76.5	72.8	63.8	55.2	46.1	33.6	55.2
Lacon	30.9	33.3	32.5	53.0	59.0	75.6	76.3	70.0	60.4	51.7	41.3	30.8	51.2
Lake Forest	28.3	30.5	26.7	44.1	55.7	69.3							
Lanark	23.0	29.9	25.0	[52.0]	57.7	71.2	72.4	66.7	57.4	48.4	36.7	25.0	[47.1]
Louisville	37.9	39.9	37.9	55.7	63.3	76.9	76.3	74.1	64.1	52.8	44.0	31.4	54.5
Martinsville	39.7	39.8	38.4	54.8	64.4	75.0	80.8	71.4	64.3	57.3	43.7	32.3	55.2
Mascoutah	38.4		37.5				79.4	74.6	66.0		48.8	34.4	
Mattoon				55.6	62.0		75.6			54.2	48.0	37.4	

[1] J. L. Cutler [2] Cotton Belt Observer. [3] R. Thomas, jr. [4] W. Holden. [5] Dr. M. M. Robbins.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Illinois—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
McLeansboro	42.2	42.1	39.9	56.4	64.4	79.3	77.6	72.3	65.4	54.9	[50.0]	36.3	[56.7]
Olney [1]	[39.0]	41.7	39.2	56.4	63.5	78.3	76.7	72.5	65.0	56.2	48.1	35.0	[56.0]
Olney [2]	39.5	40.0	38.0	55.3	61.0	76.7	75.8	71.4	63.1	53.9	45.8	33.3	54.5
Oswego	28.3	30.2	28.2	47.2	54.8	72.9	72.2	67.4	58.4	49.4	39.2	27.6	48.0
Ottawa	32.2	34.1	32.9	52.0	59.0	76.0	79.5	71.0	61.4	53.0	42.6	29.8	52.0
Palestine	40.7	38.1	37.8	55.3	61.6	73.0	74.7	69.2	61.5	52.8	45.9	32.4	53.6
Pana	38.7	40.1	38.4	57.9	63.6	79.5	78.9	73.6	65.3	57.5	47.2	34.8	56.3
Peoria	32.8	35.7	35.1	55.8	61.4	78.9	79.2	73.3	64.1	54.7	44.2	33.8	54.1
Philo	35.1	35.5	34.5	53.4	59.7	77.4	74.8	70.1	61.9	52.6	42.8	31.5	52.4
Pontiac	32.0	34.5	32.8	51.2	57.2	75.1	74.6	71.0	62.2	52.4	42.6	31.9	51.9
Riley	25.6	28.5	25.6	46.0	53.4	70.0	70.8	65.2	57.9	48.9	38.4	25.6	46.3
Rockford	26.3	29.4	26.3	48.4	55.1	72.0	73.2	67.7	58.0	49.4	39.0	27.2	47.7
Rock Island Arsenal	28.8	34.0	29.9	55.3	58.9	68.4	69.1	71.1	63.8	52.6	42.3	30.2	50.4
Rushville	30.5	32.9	32.3	54.3	60.6	75.8	75.2	69.3	60.4	52.4	42.1	32.2	51.5
Sandwich	31.6	33.3	------	------	------	------	73.4	------	65.0	------	41.0	29.8	------
Springfield	33.3	35.8	34.2	54.0	60.0	76.0	75.9	71.0	62.7	54.4	45.2	34.0	53.0
Sycamore	27.2	29.5	27.1	47.0	54.4	71.5	71.0	65.8	57.4	48.3	38.1	27.0	47.0
Watseka	33.3	33.9	32.3	51.3	57.7	74.3	72.8	67.3	60.0	51.4	42.5	[30.0]	[50.6]
White Hall	35.9	37.2	37.5	58.3	64.6	80.2	80.4	74.8	65.7	56.8	47.4	36.0	56.2
Winnebago	26.3	30.0	28.4	51.9	56.6	74.4	75.4	69.8	61.1	57.3	39.2	25.8	49.7
Indiana:													
Angola	34.9	33.5	32.1	50.2	58.5	80.1	77.8	69.6	61.7	54.4	42.4	30.5	52.1
Butlerville	40.7	42.2	35.6	54.6	60.0	74.0	73.5	70.7	63.9	54.4	46.0	32.2	54.0
Cannelton	41.4	40.9	39.1	54.0	62.0	75.2	[77.0]	72.6	[68.0]	56.3	46.0	33.9	[55.5]
Columbia City	34.0	34.0	31.9	51.1	59.7	75.1	74.1	68.7	60.4	51.2	41.7	29.3	50.9
Columbus	40.1	40.4	38.3	53.8	61.6	75.7	75.2	69.8	62.8	53.3	44.4	31.6	53.9
Connersville	40.0	37.4	33.5	54.4	60.5	75.1	75.4	69.1	59.5	50.7	45.5	31.5	52.7
Crandall	------	------	------	------	66.7	------	74.0	73.0	65.0	------	44.0	------	------
DeGonia Springs	43.7	43.9	40.4	58.4	63.7	79.2	77.1	72.8	66.1	55.7	48.8	37.1	57.2
Delphi	33.6	34.8	31.6	49.2	56.5	76.0	71.4	66.3	57.6	50.3	40.8	29.4	49.8
Farmland	39.2	40.0	35.8	52.4	60.7	75.9	72.3	70.0	62.1	52.9	45.7	32.8	53.3
Franklin	38.5	39.4	36.1	53.7	61.8	77.6	75.0	70.0	62.0	52.8	44.7	32.1	53.6

Huntingburg	44.2	43.2	40.5	59.4	68.5	82.3	[77.0]	73.9	65.9	54.7	48.8	[34.0]	[57.7]
Indianapolis	37.4	38.8	36.1	53.7	61.6	76.7	75.6	71.1	62.9	55.1	46.5	33.1	54.0
Jeffersonville	44.3	44.2	40.0	57.5	65.1	78.0	77.5	72.9	66.2	55.8	48.0	37.4	57.2
Laconia	43.4	43.7	39.1	57.8	61.6		78.7						
La Fayette	35.5	38.0	34.0	53.2	59.4	75.7	74.2	70.2	61.9	53.8	44.6	31.6	52.7
Logansport	33.5	33.7	31.7	51.8	57.7	73.4	76.6	67.9	59.7	51.3	42.9	32.4	51.0
Marengo	45.7	45.3	42.6	58.8	65.6	78.1	78.0	74.0	67.2	57.2	49.5	[36.0]	[57.3]
Marion	36.1	34.5	29.0	50.9	59.0	73.3	73.7	67.5					
Mauzy	36.0	36.0	32.5	50.2	60.6	75.9	70.8	*f*68.0	58.3	48.6	40.2	28.0	50.4
Mount Vernon	42.3	42.4	39.6	56.1	64.2	80.1	78.2	[76.0]	[68.0]	54.3	49.6	34.3	[57.1]
Muncie	36.2	39.7	37.4	54.0	63.8	80.8	73.6	74.0	62.1	56.7	46.4	34.3	54.9
New Providence	40.6	41.3	34.6	52.5									
Point Isabel	34.5	34.0	37.0	51.5	58.0	72.8	69.4	65.4	56.8	47.6	38.2	24.7	49.2
Princeton	42.2	42.5	39.0	54.7	61.8	79.0	77.4	70.9	65.4	55.0	43.3	33.7	55.4
Richmond	36.3	37.8	33.7	52.3	59.6	77.2	74.4	70.6	61.4	42.7	[42.0]	[32.0]	[51.7]
Rockville	[35.0]	[36.0]	35.7	55.8	62.9	75.5	73.4	69.6	61.8	54.6	46.6	33.8	[53.4]
Seymour	42.8	41.9	38.5	55.2	63.5	77.5	78.5	73.5	66.6	55.0	46.5	36.5	56.3
Shelbyville	36.0	40.9	37.2	56.4	65.2	78.5	[75.0]	[71.0]	[62.0]	55.3	46.0	33.4	[54.7]
Spiceland	39.0	39.5	35.6	53.7	62.5								
Sunman	39.9	40.4	35.0	53.4	61.3	75.3	73.8	68.2	63.4	53.2	[47.0]	[35.0]	[53.8]
Terre Haute						78.1	75.7	73.1	63.5		47.0		
Valparaiso					51.8	71.4			71.0	51.4	41.6	32.4	
Vevay	43.9	44.2	39.4	56.6	64.3	77.4	76.0	71.6	66.1	56.4	48.0	35.9	56.7
Worthington	39.1	38.4	35.3	54.9	57.2	75.2	74.6	69.9	61.4	54.4	43.6	30.9	52.9
Indian Territory:													
Caddo Creek	42.6	45.9	54.7	64.3	73.0	80.3	84.8						
Fort Gibson	43.2	46.2	*k*52.0	62.0	69.3	78.2	84.5	80.0	70.5	[60.0]	[50.0]	[45.0]	[61.7]
Fort Supply[3]	34.0	39.2	48.2	[58.0]	66.2	76.6	82.9	78.8	66.6	59.7	48.5	42.4	[58.4]
Fort Supply[4]	36.1	40.2	48.2	58.2	66.8	77.1							
Healdton	54.5	49.3	52.2	61.7	70.4	78.5	84.9	*d*82.6	72.4	60.9	52.6	48.0	64.0
Iowa:													
Afton							74.8	67.9	61.3	49.5			
Alta	10.9	18.2	23.9	48.1	57.5	71.5	74.2	67.6	60.0	48.1	36.7	28.0	45.4
Amana	21.2	28.0	28.8	51.2	57.1	73.0	74.8	68.0	59.1	49.4	39.0	28.3	48.2
Ames	18.1	24.8	28.0	53.5	58.0	73.3	76.8	68.5	59.9	49.2	[41.0]	[32.0]	[48.6]
Atlantic	[19.0]	[26.0]	[30.0]	*k*58.4	58.2	73.1	76.9	67.4	56.0	48.2	37.0	29.8	[48.3]
Bancroft	12.7	19.3	23.2	49.5	54.6	70.6	73.7	66.3	59.3	46.5	34.4	*g*23.7	44.5
Belle Plaine	19.9	26.6	27.5	48.7	55.9	71.9	74.5	67.1	57.4	48.6	37.5	27.2	46.9

[1] Victor E. Phillips. [2] C. H. Fahs. [3] Signal Service. [4] Medical department.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Iowa—Continued.													
Blakeville	19.9	27.7	26.7	51.4	56.2	74.0	76.8	68.8	62.3	50.8	39.9	[27.0]	[48.5]
Carroll	14.8	22.9	27.6	50.3	56.7	76.2	73.8	65.8	59.2	48.8	38.6	30.1	47.1
Carson	19.4	25.5	30.0	53.6	59.3	73.8	78.6	70.6	61.8	51.6	40.6	31.6	49.7
Cedar Rapids	23.8	28.7	29.1	52.2	57.5	73.5	75.5	70.0	59.6	50.6	39.4	29.1	49.1
Clarinda	20.7	25.9	31.2	54.5	62.1	76.5	80.2	71.1	61.7	51.7	40.0	32.3	50.7
Clinton	26.0	29.6	28.8	51.8	57.6	74.4	75.6	68.6	58.8	49.8	38.4	28.1	49.0
Cresco	14.4	21.0	22.6	47.3	53.2	68.6	70.8	63.9	55.8	44.9	33.6	22.3	43.2
Davenport	26.6	31.4	30.0	52.6	58.0	74.4	76.2	70.2	61.8	52.1	42.0	30.4	50.5
Des Moines	20.6	26.9	29.7	52.8	58.4	73.2	76.9	69.6	61.0	51.5	41.2	32.3	49.5
Des Moines (near)	20.5	27.4	30.0	54.2	60.0	73.6	77.7	70.0	61.1	[51.0]	[41.0]	[32.0]	[49.9]
Dubuque	22.2	28.6	27.9	51.2	56.4	73.6	75.4	68.8	59.8	50.6	39.8	27.2	48.5
Eagle Grove	13.8	21.0	34.6	50.8	56.8	74.7	77.8	69.4	60.9	47.8	36.5	a26.7	47.6
Elkader	19.2	25.4	27.2	49.3									
Fayette	16.7	24.7	24.5	48.2	53.1	69.6	70.9	65.2	56.2	47.0	35.9	[26.0]	[44.8]
Fort Madison	28.9	32.4	32.2	53.7	61.0	77.5	79.2	72.0	62.6	51.7	42.4	32.2	52.2
Glenwood[1]	16.6	25.9	32.8	56.8	61.9	77.2	81.9	73.6	64.7	53.0	42.9	34.3	51.8
Greenfield									59.5	49.9	38.0	29.9	
Grinnell	17.9	26.1	25.2	53.9	60.7	73.8	76.4	69.0	60.2	49.6	39.5	29.2	48.5
Hampton	14.2	20.4	22.7	47.2	53.5	69.0	71.5	65.0	55.1	44.9	34.8	24.0	43.5
Humboldt	14.5	21.8	25.2	50.8	58.4	71.6	73.8	65.0	58.3	47.3	36.6	26.1	45.8
Independence	17.4	d21.4	27.3	50.4	56.2	72.2	73.6	67.1	58.6	48.7	37.9	26.6	46.4
Indianola					58.9	73.2				52.0	40.8	d31.5	
Iowa City	23.9	32.1	30.3	49.0	53.8	67.6	m75.1	66.0	58.8	50.8	44.8	33.1	48.8
Irwin					57.3	71.4	75.7	68.1					
Keokuk	29.4	32.8	32.6	54.7	60.0	76.2	78.0	71.2	62.7	54.1	44.2	33.8	52.5
Larrabee	11.2	18.8	24.3	48.8									
Logan	19.2	26.5	31.6	56.2	59.7	72.8	77.0	70.4	63.8	53.8	41.9	33.8	50.6
McCausland	27.2	32.0	31.3	54.6	61.1	76.2	78.3	71.7	58.0	47.1	38.3	28.5	50.4
Manson	15.1	21.5	24.8	54.4	57.4	71.4	73.5	68.3	56.6	44.7	32.6	25.9	45.5
Maquoketa	24.8	30.1	29.8	52.3	e53.4	73.2	74.3	68.4	57.4	49.5	38.1	27.7	48.2
Monticello	21.7	27.3	27.8	50.9	56.6	73.2	73.9	66.7	58.2	48.0	37.5	26.0	47.3
Mount Pleasant	25.7	29.1	28.4	52.8	58.4	74.9	75.6	68.9	61.5	49.6	42.0	34.3	50.1

Mount Vernon	22.0	[27.0]	28.4	54.7	58.7	71.9	72.8	69.9	61.3	51.3	40.1	28.6	[48.9]
Muscatine[2]	26.7	31.5	29.9	52.2	58.8	73.8	75.7	68.9	58.7	50.6	40.8	29.1	49.7
Osage	[15.0]	[22.0]	[27.0]	m48.8	52.2	68.5	70.3	62.0	53.6	43.3	32.4	22.5	[43.1]
Oskaloosa[3]	22.8	29.0	30.4	54.1	60.0	73.8	77.6	69.3	60.2	50.9	41.8	32.9	50.2
Panama	------	------	------	------	------	------	------	------	59.1	51.3	40.6	26.6	------
Sac City	12.6	20.9	23.4	48.8	52.3	69.5	74.3	63.3	56.7	46.0	33.8	25.0	53.0
Sioux City	14.0	22.9	28.4	52.1	57.8	72.4	76.0	69.0	61.8	50.2	40.4	31.5	48.0
Storm Lake	12.1	19.4	23.7	49.4	56.3	71.7	75.0	67.8	59.8	47.8	35.9	27.5	45.5
Vinton	18.8	26.2	26.9	50.7	56.0	71.6	74.0	66.6	57.3	47.9	37.7	27.0	46.7
Washington	25.8	31.4	31.8	55.5	60.8	78.4	80.9	72.7	63.2	48.1	41.9	31.9	51.9
Webster City	15.1	21.6	25.2	50.8	55.2	71.7	74.5	66.4	58.0	46.9	33.8	25.0	45.4
Wesley	13.6	19.8	23.6	48.1	54.0	69.0	71.4	63.8	------	------	------	------	------
West Bend	12.7	19.4	33.8	45.3	54.1	68.6	73.2	64.9	57.4	45.9	34.7	23.4	44.4
Kansas:													
Abilene	27.1	31.6	38.4	54.5	62.1	75.7	83.4	74.4	65.6	55.5	42.9	[37.0]	[54.0]
Allison	18.5	23.4	33.6	50.1	63.0	76.2	82.7	73.8	61.1	50.8	36.5	27.5	49.8
Alton	------	------	------	------	------	77.9	84.0	76.8	65.6	53.7	42.2	35.6	------
Bunker Hill	28.3	33.9	41.6	58.0	------	------	------	------	------	------	------	------	------
Cawker City	23.8	31.7	[36.0]	54.5	67.2	78.5	85.6	76.8	[66.0]	52.8	41.8	34.2	[54.1]
Collyer	23.6	31.3	43.8	53.9	68.8	81.1	88.8	78.3	69.0	55.4	[43.0]	35.2	[56.0]
Concordia	21.0	29.4	38.0	55.6	62.8	75.6	82.3	73.8	64.9	54.2	44.6	36.4	53.2
Concordia (near)	19.4	28.6	37.3	55.5	58.2	72.2	79.3	70.2	61.4	51.0	40.4	[36.0]	[50.7]
Conway	24.3	32.0	38.4	55.8	64.5	------	79.5	------	------	------	------	------	------
Cunningham	27.5	32.4	40.9	55.4	64.0	76.7	83.0	78.3	65.1	55.5	42.1	34.9	54.6
Dodge City	27.2	32.4	42.5	54.2	63.6	75.0	82.4	76.4	65.2	55.5	44.4	38.8	54.8
Elco	[26.0]	[32.0]	39.3	56.7	65.2	74.8	81.3	75.4	64.7	57.1	45.3	38.4	[54.7]
Elk Falls	35.2	[37.0]	[44.0]	g58.3	65.4	73.6	80.6	80.4	71.1	65.5	54.6	42.5	[59.0]
Ellis[4]	25.9	32.4	39.9	52.0	58.8	------	92.4	67.9	------	------	------	------	------
Ellis[5]	25.0	33.2	------	------	69.8	84.6	------	------	------	------	43.7	------	------
Emporia	29.4	34.2	40.4	56.7	63.1	[75.0]	81.6	73.8	63.0	55.2	45.0	37.0	[54.5]
Englewood	32.8	36.6	45.9	58.0	66.9	78.4	85.0	78.9	67.4	57.2	45.5	39.2	57.6
Eureka Ranch	25.5	30.7	41.7	55.5	66.2	80.0	86.2	78.2	68.7	56.2	43.1	37.1	55.8
Fort Leavenworth[6]	27.3	33.0	37.9	55.8	63.3	75.8	[78.0]	70.9	64.5	55.5	f46.1	37.4	[53.8]
Fort Leavenworth[7]	24.4	30.3	35.4	55.9	61.5	76.0	78.7	71.6	61.3	53.2	43.6	34.8	52.2
Fort Riley	22.2	30.5	38.7	56.9	63.0	76.2	83.1	75.2	65.5	55.1	45.3	36.8	54.0
Fremont	23.3	29.6	40.7	53.3	61.5	75.8	83.1	76.0	64.7	55.4	42.2	37.5	53.6
Gibson	------	------	39.6	52.0	62.9	79.3	85.4	76.2	65.4	------	------	------	------
Globe	24.8	29.4	34.8	53.8	61.8	75.4	79.0	72.7	61.0	51.7	40.0	32.0	51.4

[1] Seth Dean. [2] J. P. Walton. Joseph Boyd [4] F. L. Williams. [5] Agent Union Pacific R. R. [6] U. S. Post hospital. [7] Military prison.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Kansas—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
Gove City	25.9	30.3	41.2	53.0	64.4	76.3	84.4	77.0	65.1	52.8	41.9	34.8	53.9
Grainfield	27.9	30.0	41.1	52.2	67.7	83.7	[86.0]	[77.0]	69.9	[55.0]	42.2	39.2	[56.0]
Greenridge		33.6	38.5	52.6	62.2								
Grenola	33.1	37.0	43.6	57.9	64.6	78.4	82.0	80.3	63.6	57.7	45.4	38.7	56.8
Grinnell	28.4	33.0	42.0	52.9	69.3	78.0	91.7	[77.0]	69.5	[55.0]	45.8	39.4	[56.8]
Halstead	28.9	32.2	42.0	56.1	64.1	75.8	82.5	76.0	64.7	57.6	43.3	37.2	55.0
Havensville	24.2	28.1	34.1	55.6	63.6	77.6	80.4	72.5	60.8	50.1	38.4	30.8	51.4
Horton	23.6	30.4	37.8	57.9	64.6	76.6	85.9	75.1	63.6	54.8	43.6	36.5	54.2
Hoxie			42.1	56.2		71.8						39.9	
Independence	35.0	37.1	43.0	58.0	65.0	76.6	81.6	76.6	66.2	58.3	47.5	38.6	58.0
Kansas City	29.1	33.2	37.4	55.8	63.2	77.7	82.3	74.8	63.7	54.9	44.4	36.1	54.4
Kellogg	31.2	37.4	46.8	58.2	66.1	79.0	87.7	81.7	68.2	58.4	46.5	38.8	58.3
La Crosse					67.8	81.0			66.2	56.6	42.3	37.4	
La Harpe	31.2	34.2	39.5	55.4	63.6	75.6	79.8	74.8	63.4	54.5	42.5	34.3	54.1
Lakin	34.2	37.1	48.2	55.9	61.0	73.2	78.3	74.5	63.6	51.9	40.4	32.9	54.3
Lawrence	27.4	32.6	37.8	56.6	63.2	77.0	80.6	73.7	63.0	54.8	44.1	36.0	53.9
Leavenworth	28.1	32.3	37.5	56.6	63.0	77.0	80.6	74.2	64.0	55.8	45.4	37.0	54.3
Lebo	29.8	35.0	40.2	56.4	64.3	76.6	81.0	74.6	64.1	56.0	45.1	36.8	55.0
Leoti	25.3	30.5	41.2	50.6	62.8	73.7	80.6	[76.0]	[69.0]	51.6	40.8	36.6	[53.2]
Lincoln	25.4	31.2	39.5	55.6	64.9	77.6	86.4	77.0	[65.0]	[55.0]	40.4	[36.0]	[54.5]
Lisbon	29.2	35.6	46.4	53.0	66.5	77.9							
Luray	27.6	31.9	42.6	57.8	69.6	79.4	87.8	75.7	[67.0]	56.4	[44.0]	[37.0]	[56.4]
McAllaster	24.4	31.3	40.4		61.5							30.9	
Macksville	24.2	31.5	33.6	51.6	61.9	73.3	79.2	74.8	65.3	52.4	43.5	[35.0]	[52.2]
Manhattan[1]	23.1	30.0	37.2	56.2	62.9	77.2	81.9	74.3	62.8	53.4	41.9	33.2	52.8
Manhattan[2]	23.1	30.6	37.2	56.7	61.5	77.5	83.0	73.8	64.7	53.7	41.4	33.7	53.1
Mankato	19.6	26.4	35.6	48.6	60.5	75.8		70.7				31.0	
Marmaton	35.6	36.4	41.5	57.3	[64.0]	78.4	[80.0]	78.0	65.2	56.8	45.5	37.2	[56.3]
Minneapolis	25.3	30.0	38.6	53.9	62.8	78.4	84.8	74.4	65.2	55.0	41.0	33.3	53.6
Monument	25.7	31.5	38.5	52.5	69.9	81.8			66.0			35.2	
Morse	28.2	30.2	36.6	58.4	61.8	75.8	80.6	73.9	61.2	55.4	45.5	35.2	53.6
Norton						74.5	80.3	74.3	64.8	52.5	41.4		

Oakley	*30.0*	34.6	47.5			82.1							
Offeree	27.5	31.0	40.8	54.5	63.2	76.3	83.4	78.9	65.4	[55.0]	[44.0]	[38.0]	[54.8]
Ogallah		29.2		52.1		80.1		73.2	61.6			33.1	
Oswego	37.8	39.2	45.5	54.4	66.3	78.3	83.8	77.7	66.9	57.4	49.6	*g*41.7	58.2
Page City								80.4	64.5		42.0	31.9	
Quenemo	28.7	34.0	39.2	56.6	61.8	76.8	80.2	75.6	[61.0]	[55.0]	[43.0]	[37.0]	[54.1]
Richfield	34.9	38.9	46.4	55.0									
Rome	34.3	36.9	43.5	58.3	64.2	77.8	83.0	79.4	66.6	58.0	44.0	38.9	56.9
Salina	23.9	32.3	40.5	57.2	65.4	79.3	86.3	76.5	65.1	55.3	42.9	35.2	55.0
Sedan	34.2	37.4	43.9	59.7	66.9	79.3	82.5	78.2	67.6	59.9	48.3	40.5	58.2
Seneca	21.2	28.2	35.8	57.9					*e*58.8	54.1	41.7	32.8	
Sharon Springs	28.3		38.4	48.6	62.8	74.7		76.2	64.8		41.2		
Shields	25.2	31.4	42.7	51.1	64.0	77.0	84.0	78.2	67.9	[55.0]	47.8	41.4	[55.5]
Topeka	25.8	32.5	37.8	56.0	62.5	75.8	80.9	74.8	64.0	55.6	44.6	36.5	53.9
Tribune	27.6	30.0	41.2	50.2	61.0	74.3	80.2	73.9	64.0	51.4	*k*41.2	35.3	52.5
Wa Keeney	26.4	32.1	42.6	55.0	65.8	77.0	83.5	76.5	65.7	[55.0]	42.9	[36.0]	[54.9]
Wellington	31.0	35.8	43.0	[57.0]	65.2	81.4	83.1	79.2	69.8	60.1	45.2	39.0	[57.5]
Weskan	30.8	37.6	46.3	53.2	66.7	75.8	76.6	74.2	64.8	[51.0]	[41.0]	39.4	[54.8]
Wichita	30.0	35.3	43.6	57.0	64.5	77.2	82.4	77.2	66.2	58.0	45.9	39.7	56.4
Wilson	28.5	35.8	44.4					66.9					
Winona	29.3	33.4	42.2	53.0	60.8	75.4		76.0					
Yates Center	30.1	34.9	39.2	56.1									
Kentucky:													
Bowling Green	47.9	49.8	44.5	62.4	67.3				70.4				
Caddo	[42.0]	32.4	29.0	[55.0]	68.7	77.1	75.2	70.4	61.8	52.6	46.7	36.0	[53.9]
Canton	45.2	46.0	47.8	60.5	67.0	79.3	78.7	73.1	67.1	56.2	48.6	39.3	59.1
Earlington	44.4	44.8	41.5	57.6	62.9	79.8	78.6	74.8	68.0	59.6	55.2	41.7	59.1
Edmonton								71.6	67.4	57.2	*d*47.3	*d*39.4	
Frankfort[3]	44.6	44.5	39.8	56.1	63.1	77.0	76.2	70.9	66.1	54.1	45.9	35.4	56.1
Franklin	46.8	48.0	44.7	59.9	65.1	77.8	78.5	72.8	69.7	58.1	52.3	40.8	59.5
Harrodsburgh					63.0	76.6	75.5	71.7	66.0	53.8	47.5	36.3	
Lexington	44.0	45.1	38.6	55.6	63.2	76.6	75.8	71.3	66.8	56.3	48.6	36.8	56.6
Louisville	44.8	46.5	41.2	58.0	64.8	78.8	78.4	74.7	68.0	57.9	51.0	38.8	58.6
Millersburgh	47.9	47.7	44.0	57.7	63.5								
Mount Sterling	43.0	44.0	38.2	53.6	61.3	75.2	73.9	68.7	65.5	53.9	47.5	35.9	55.1
Murray	45.2	45.1	43.4			78.5	77.7						
Newport Barracks	42.2	43.4	38.2	54.8	63.2	77.0	76.3	71.8	65.0	55.2	47.3	33.0	55.6
Owenton	38.5	*d*42.2	*e*38.0	*d*50.9	60.6	*e*77.0	73.1						

[1] C. M. Breese. [2] C. P. Blachley. [3] E. C. Went.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Kentucky—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
Pellville	45.4	47.8	41.8	58.0	64.4	78.6	78.7	74.2	66.2	55.0	48.5	37.2	58.0
Princeton	43.4	46.2	43.2	58.4	65.6	78.7	78.2	74.8	66.5	55.4	48.3	38.2	58.1
Richmond	w45.7	46.4	40.7	57.3	65.1					55.2	48.8	36.8	
Shelbyville	44.0	44.2	40.2	56.4	64.5	76.6	76.8	70.8	65.6	54.1	46.0	35.0	56.2
South Fork	47.4	48.3	42.3	57.1	62.5	74.5	73.5						
Springfield													
Louisiana:													
Abbeville	65.6	64.5	62.0	71.4	75.6	80.4	81.6	81.6	77.4	69.7	[62.0]	56.4	[70.7]
Alexandria					71.6	79.5	82.9	81.8	76.6	67.0	59.0		
Amite City	63.2	62.3	58.6	68.4	73.0	79.9	81.2	80.0	76.4	67.6	60.8	52.8	68.7
Baton Rouge	62.3	61.4	58.8	69.2	72.7	80.4	82.2	80.6	76.3	67.6	61.4	55.3	69.0
Cameron	64.9	63.8	62.6	72.0	76.4	81.2	81.8	81.2	77.8	70.0	63.7	56.0	71.0
Cheneyville	[63.0]	[63.0]	59.6	68.0	72.6	79.2	81.3	79.2	74.8	65.4	58.8	[53.0]	[68.2]
Clinton	57.5	60.2	57.4	67.0	72.8	d78.4	80.4	78.0	75.0	67.8	62.3	d54.9	67.6
Columbia	58.9		i58.2	67.8	72.1	79.2	83.0	80.4					
Convent	64.9	65.4	61.8	70.5	75.7								
Coushatte	57.7	55.6	55.5	[65.0]	72.6	80.2	82.8	81.5	75.4	65.9	58.6	[51.0]	[66.8]
Crowley	64.9	62.2	59.2	69.0	72.8	81.0	81.6	79.9	75.5	70.4	63.8	55.4	69.6
Davis									71.0	c63.3	57.0	47.8	
Donaldsonville	62.6	61.1		68.0	71.7	78.2	79.8	78.7	74.2				
Edgard	62.0	65.8	61.6	70.2	73.7	79.4	79.8	80.2	77.2	68.8	63.4	55.5	69.8
Emile	64.4	62.6	60.2	69.6	74.4	80.7	81.6	79.9	76.0	66.7	61.6	53.8	69.3
Farmerville	56.4	56.7	55.3	66.0	71.8	79.6	82.7	80.0	72.4	62.4	56.6	51.8	66.0
Girard	l64.0	66.0	62.1					75.0					
Grand Cane	57.0	58.7	59.8	64.0	73.4	80.6	[83.0]	80.4	74.6	[66.0]	[58.0]	49.8	[67.1]
Grand Coteau	64.0	64.5	61.2	70.0	74.3	79.3	81.4	79.5	74.7	66.8	60.8	56.5	69.4
Hammond	64.1	65.2	59.8	68.0	75.2	80.2	81.4	80.2	75.9	[68.0]	[61.0]	[55.0]	[69.5]
Homer								80.3	74.0	64.3	57.6	40.8	
Houma	64.9	62.7	61.7	69.8	73.6	79.5	80.2	79.4	77.4	65.0	[64.0]	54.6	[69.4]
Jackson Barracks	[64.0]	[64.0]	g62.8	69.4	73.8	80.6	81.4	80.6	77.5	68.7	62.7	53.8	[69.9]
Jeanerette	66.0	60.5	62.1	69.4	73.1	80.3	81.8	81.3	75.4	67.6	64.3	56.2	69.8
La Fayette	[65.0]	63.9	61.7	69.8	72.8	80.2	82.6	81.0	76.4	68.4	62.4	[56.0]	[70.0]

Lake Charles	62.2	60.2	57.4	68.2	72.6	82.8	77.9	76.4	71.5	62.3	60.3	53.0	67.1
Liberty Hill	57.7	58.0	56.0	66.8	73.0	78.5	83.0	81.0	73.7	64.0	58.0	50.0	66.6
Luling	63.7	62.1	57.8	67.4	70.3	77.5	78.9	77.3	74.1	65.8	[64.0]	d50.0	[67.4]
Mandeville	64.3	65.7	60.2	70.6	73.4	84.5	84.0	83.6	78.3	67.2	61.2	53.6	70.6
Marksville	62.6	62.6	59.6	70.2	74.4	80.1	80.2	79.0	[75.0]	65.6	60.6	54.2	[68.7]
Maurepas	63.6	61.0	61.8	70.0	73.0	78.2	80.3	78.8	75.1	65.6	61.2	53.0	68.5
Melville	65.8	61.6	60.1	69.4	74.2	79.8	82.4	80.6	76.1	66.2	61.2	52.6	69.2
Minden	57.2	56.4	57.1	[66.0]	72.5	79.4	83.4	81.1	74.6	64.4	57.2	54.0	[66.9]
Monroe	56.0	57.5	56.6	[66.0]	71.6	79.2	82.2	79.4	73.3	63.8	57.4	50.5	[66.1]
Natchitoches	------	------	------	------	72.6	80.0	82.6	80.3	72.0	65.2	58.3	------	------
New Iberia	66.3	65.6	62.0	[68.0]	72.9	80.1	81.8	81.2	78.0	69.0	64.4	56.9	[70.5]
New Orleans	65.1	64.0	61.6	70.3	74.4	80.6	81.6	80.6	77.6	69.0	64.0	56.4	70.4
Paincourtville	[63.0]	[64.0]	61.2	69.4	74.4	81.2	82.2	81.2	76.2	67.6	62.1	[57.0]	[70.0]
Plaquemine	61.9	60.8	58.5	67.8	74.2	78.8	79.5	79.0	73.8	[68.0]	60.6	51.2	[67.8]
Port Eads	65.8	66.3	65.1	69.8	73.6	80.6	81.8	82.0	------	------	------	------	------
Shell Beach	61.8	61.6	59.2	69.3	74.0	81.5	82.2	80.4	75.6	67.8	[64.0]	[55.0]	[69.4]
Shreveport	56.6	57.4	57.0	66.5	73.2	79.5	83.0	80.6	73.8	64.6	58.1	52.2	66.9
Sugar Exchange Station	64.4	62.4	60.6	69.5	73.8	f80.1	80.8	79.4	76.9	65.2	62.0	54.0	69.1
Vidalia	61.1	61.4	58.4	------	72.5	80.5	------	------	------	------	------	------	------
Winnsboro	------	------	------	------	------	78.8	79.5	77.8	------	------	66.0	61.2	------
Maine:													
Bar Harbor	22.6	24.7	31.4	41.6	51.6	58.5	65.0	65.9	59.2	48.0	37.6	18.3	43.7
Belfast	21.0	24.9	30.4	42.3	51.3	58.3	64.7	63.6	57.3	46.3	35.1	15.1	42.5
Calais	17.6	22.4	29.6	40.0	52.0	58.2	66.4	65.2	57.6	45.6	36.2	16.4	42.3
Cornish	21.0	23.6	28.6	42.6	55.0	63.8	69.4	67.4	59.4	46.4	34.6	14.6	43.9
Eastport	20.6	23.4	29.4	39.2	47.9	54.0	60.8	61.4	57.0	46.6	36.2	17.6	41.2
Fairfield	16.0	20.5	28.0	41.0	52.8	61.1	66.7	65.6	57.3	45.2	34.0	7.4	41.3
Farmington	15.5	18.4	26.2	38.4	50.7	59.1	64.0	63.2	55.2	43.4	30.5	6.4	39.2
Fort Preble	------	------	------	------	52.4	------	68.2	65.4	60.8	51.0	38.5	19.4	------
Gardiner	20.5	24.9	29.5	------	52.4	------	------	------	------	------	------	------	------
Kennebec Arsenal	16.5	19.8	30.1	38.0	52.1	59.8	67.0	65.4	57.7	49.9	31.8	7.0	41.3
Kent's Hill	17.4	19.1	25.9	40.4	51.8	59.2	66.4	64.1	57.6	45.2	32.3	11.4	40.9
Lewiston	19.1	22.3	27.0	39.7	51.4	60.8	66.6	65.5	58.1	45.4	32.9	11.9	41.7
Mayfield	------	------	------	37.0	48.8	58.2	64.6	66.2	53.6	41.4	27.3	------	------
Orono	17.6	22.7	28.9	40.2	52.1	59.5	66.2	64.8	57.9	45.5	34.7	11.4	41.8
Petit Manan	24.1	25.2	31.7	41.5	49.7	57.4	60.1	62.6	58.7	47.2	38.4	21.5	43.2
Portland	23.2	26.6	30.7	42.1	52.1	60.6	67.4	65.9	59.7	47.7	36.9	17.0	44.2
West Jonesport	23.6	23.6	30.8	38.2	47.8	54.4	59.7	60.9	56.7	47.1	35.2	20.8	41.6

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Maryland:													
Baltimore	44.0	43.4	41.6	54.0	64.0	75.0	75.4	74.1	68.4	57.0	48.2	34.6	56.6
Barren Creek Springs	45.1	45.4	42.1	52.6	62.9	73.6	75.4	72.5	67.7	56.0	47.2	36.4	56.4
Cumberland[1]	40.7	40.0	36.3	51.8	61.4	72.6	73.9	69.8	63.2	52.7	44.3	31.8	53.2
Cumberland[2]	43.6	42.4	38.2	54.0	62.3	74.2	77.4	73.4	66.6	56.2	47.8	34.2	55.9
Fallston	41.0	40.5	37.8	51.2	61.0	71.7	72.0	[68.0]	[57.0]	52.0	44.5	31.5	[52.4]
Fort McHenry	42.0	42.5	40.5	52.6	62.5	73.3	73.9	71.8	66.4	54.6	46.1	33.0	54.9
Frederick	43.0	42.4	45.8	54.9	62.1	74.0	73.2	73.2	66.8	56.4	47.4	33.8	56.1
Gaithersburg	37.6	38.0	35.4	49.6	59.2	70.9	71.0	69.0	62.8	51.1	42.7	29.0	51.4
Galena	42.6	41.8	40.1	54.2	64.4	75.2	----	----	----	----	----	----	----
Jewell	44.4	43.6	41.2	54.9	65.4	76.4	77.0	75.2	69.8	57.1	48.6	35.2	57.4
Leonardtown	44.2	44.2	41.8	53.0	61.0	----	----	----	----	----	----	----	----
McDonogh	41.2	41.3	38.1	51.9	61.2	73.0	74.4	71.1	65.7	54.7	45.9	32.2	54.2
Mount St. Mary's	40.6	40.2	39.0	53.2	61.4	73.0	[73.0]	[73.0]	66.0	54.8	42.5	31.3	[54.0]
Woodstock	42.2	[43.0]	39.0	52.2	62.2	72.2	73.6	71.3	63.1	53.8	44.6	32.2	[54.1]
Massachusetts:													
Amherst[3]	31.8	32.4	31.9	46.6	57.1	65.4	70.0	67.1	59.4	48.1	37.6	23.9	47.6
Amherst[4]	30.5	30.8	30.2	45.4	56.4	64.6	68.1	66.3	59.4	47.4	36.2	21.7	46.4
Amherst[5]	33.2	[31.0]	31.0	45.8	57.0	66.5	68.4	67.2	59.7	48.5	37.2	22.9	[47.4]
Andover	30.5	30.3	31.8	44.8	57.2	63.1	69.8	67.3	61.4	48.3	37.1	23.2	47.1
Blue Hill (summit)	30.5	30.5	31.2	42.9	53.9	61.4	68.0	65.9	60.1	47.5	38.2	23.4	46.1
Blue Hill (base)	32.2	32.2	33.2	45.1	56.6	62.8	69.2	67.2	61.7	48.4	39.4	24.5	47.7
Blue Hill (valley)	31.9	32.5	32.9	45.0	57.1	63.2	68.4	65.7	61.3	47.7	39.5	24.7	47.5
Boston	32.4	33.2	34.9	46.3	57.0	64.2	71.0	68.9	62.9	51.0	41.8	26.0	49.1
Brewster	35.9	36.2	35.6	44.4	55.8	64.3	71.8	69.0	64.4	51.2	42.8	29.8	50.1
Cambridge[6]	30.0	31.2	32.2	44.8	56.6	63.2	68.4	67.9	61.4	48.8	40.0	23.8	47.4
Cambridge[7]	30.3	31.7	33.0	46.3	57.8	64.4	72.0	69.0	62.1	48.6	39.2	23.8	48.2
Chestnut Hill	32.0	32.0	33.1	45.8	57.2	64.7	70.9	69.0	63.2	49.8	40.4	25.4	48.6
Concord	----	----	----	----	----	----	70.2	67.5	60.8	47.8	37.9	21.6	----
Cotuit	34.2	34.2	34.6	44.0	54.4	62.6	69.0	68.2	63.3	50.4	41.1	27.7	48.6
Deerfield	29.8	30.6	30.8	46.4	58.6	67.0	70.6	68.2	59.5	48.5	36.2	21.1	47.3
Dudley	29.3	30.8	30.8	44.4	57.7	66.1	70.8	68.6	61.3	48.4	39.2	22.4	47.5
Fall River[8]	35.5	33.3	32.6	44.0	53.6	62.8	68.9	68.4	64.4	49.9	42.3	28.0	48.6

Fall River[9]	--------	34.4	33.9	45.6	55.4	--------	70.6	--------	--------	--------	--------	--------	--------
Fitchburg[10]	28.5	28.7	30.4	44.0	56.7	63.6	69.5	66.0	59.6	46.7	36.5	20.8	45.9
Fitchburg[11]	28.9	30.3	31.8	45.5	56.8	63.4	68.7	66.4	60.6	47.1	36.7	20.3	46.4
Fort Warren	27.5	29.2	29.9	39.7	53.8	63.2	68.7	64.3	57.9	50.4	39.6	25.6	45.8
Framingham	32.3	32.6	32.9	47.0	58.2	65.4	71.2	69.2	62.2	48.5	39.8	24.1	48.6
Gilbertville	32.1	30.8	31.1	45.3	57.8	64.2	69.2	66.7	60.2	46.2	37.2	22.3	46.9
Groton	29.7	30.0	33.5	46.2	58.3	64.8	70.8	67.9	61.8	48.3	37.9	22.0	47.6
Heath	27.1	26.8	28.6	40.5	55.3	65.4	71.0	66.6	56.8	49.4	33.2	*d*16.4	44.8
Kendall Green	31.4	32.4	33.2	47.5	59.2	66.8	72.2	70.4	62.7	49.6	40.1	[26.0]	[49.3]
Lake Cochituate	29.4	32.6	33.2	46.3	58.0	65.4	69.7	68.2	60.9	46.6	38.9	23.8	47.8
Lawrence	28.6	30.2	32.1	45.4	58.4	64.8	75.4	69.7	61.8	48.5	37.4	21.1	47.8
Leicester	28.9	28.4	29.3	43.9	54.6	62.1	67.4	*d*65.8	59.8	46.6	35.8	23.3	45.5
Long Plain	33.4	33.4	33.6	46.2	55.8	64.6	71.6	70.4	64.4	50.6	40.2	25.8	49.2
Lowell[12]	28.5	30.5	31.6	44.8	57.6	64.3	70.3	68.4	61.6	48.0	38.1	21.7	47.1
Lowell[12]	28.7	30.7	31.7	44.8	57.2	63.2	69.2	67.3	61.1	47.3	37.4	21.3	46.7
Lowell[13]	29.0	30.6	34.0	47.0	58.3	65.3	72.0	68.4	63.4	50.1	38.9	21.9	48.2
Ludlow[14]	31.8	33.7	30.8	46.1	57.5	65.4	69.6	65.5	58.0	46.2	35.8	20.2	46.7
Ludlow[15]	30.5	30.4	28.9	43.5	54.6	62.6	66.7	68.7	60.3	48.9	38.6	23.8	46.5
Lynn	30.8	32.1	[24.0]	45.0	54.8	62.0	68.4	67.0	59.5	47.3	36.7	22.3	[46.7]
Mansfield	32.4	32.8	32.6	45.4	55.8	62.8	69.4	68.6	61.0	49.0	38.9	24.6	47.8
Middleboro	32.9	33.8	34.0	44.4	55.6	61.8	68.0	67.0	61.2	48.2	39.4	25.7	47.7
Milton	32.9	33.5	34.3	44.8	55.1	62.0	68.0	65.5	59.2	48.3	39.9	25.6	47.4
Monson	30.2	30.8	30.1	44.2	56.3	64.2	67.1	66.6	59.6	47.5	36.3	21.4	46.2
Nahant	31.9	31.8	35.7	43.9	53.4	62.3	68.6	66.8	61.4	*b*50.0	42.1	*e*29.7	48.1
Nantucket	34.6	35.6	35.7	43.6	51.9	60.4	67.2	67.7	63.8	52.5	44.0	31.1	49.0
Natick	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
New Bedford	34.6	33.5	33.4	44.0	53.8	61.8	67.0	66.5	61.6	49.2	40.8	27.4	47.8
New Bedford	35.4	35.0	35.1	45.8	54.8	63.8	68.8	67.6	62.8	50.2	41.3	28.2	49.1
Newburyport	29.7	31.3	33.0	44.9	56.0	63.2	69.2	66.8	60.9	48.5	39.0	23.6	47.2
Northampton	31.6	31.4	31.5	47.0	59.6	68.7	72.1	70.5	63.2	49.2	37.4	23.0	48.8
North Billerica	30.8	31.9	33.1	46.4	59.0	65.9	71.6	68.4	62.2	48.6	39.3	24.0	48.4
Plymouth	[34.0]	32.6	35.8	46.2	58.3	64.3	70.9	69.1	63.4	51.3	42.4	28.4	[49.7]
Princeton	28.2	27.3	29.2	44.1	55.2	[64.0]	67.8	65.1	59.7	46.8	[39.0]	*ww*.0	[45.7]
Provincetown	[36.0]	35.0	35.1	44.5	54.4	62.8	70.4	68.8	63.6	50.7	[44.0]	30.7	[49.7]
Royalston	33.0	33.1	34.0	48.2	58.2	65.8	70.6	67.3	61.7	[48.0]	*e*40.4	23.2	[48.6]

[1] E. T. Shriver.
[2] Howard Shriver.
[3] Miss S. C. Snell.
[4] Agricultural Experiment Station.
[5] Hatch Experiment Station.
[6] Harvard College Observatory.
[7] E. C. Brooks.
[8] C. V. S. Remington.
[9] Patrick Kiernan.
[10] Dr. J. Fisher.
[11] Dr. A. P. Mason.
[12] Prop. locks and canals.
[13] F. E. Saunders.
[14] M. W. Graves.
[15] J. Haviland.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Massachusetts—Continued.													
Salem		33.6	39.2	45.0	54.8	62.8	68.4	67.1	60.8				
Somerset	35.4	35.3	35.2	47.5	61.4	67.8	73.1	71.8	65.6	51.5	42.5	28.1	51.3
Springfield Armory	31.1	32.8	32.1	47.6	58.9	67.5	71.9	70.1	61.9	49.6	38.6	22.2	48.7
Taunton[1]	34.5	34.3	35.1	46.0	56.4	64.0	68.7	69.3	62.4	49.4	41.0	27.4	49.0
Taunton[2]	33.7	35.0	34.7	46.1	57.4	64.7	73.4	67.4	62.9	49.8	40.6	27.4	49.4
Taunton[3]	34.2	34.2	33.8	45.2	56.0	63.0	69.0	68.2	62.6	48.1	39.8	27.1	48.4
Vineyard Haven	39.5	38.4	37.6	47.4	56.4	65.0	70.6	70.1	65.8	54.1	45.0	31.9	51.8
Wakefield	34.0	29.8	30.8	41.4	56.1	63.0	70.7	66.5	60.7	47.5	[39.0]	25.1	[47.0]
Wellesley	33.4	34.1	33.5	46.7	57.3	64.0	70.2	68.5	62.4	48.0	40.4	29.7	49.0
Westboro	31.7	33.6	34.3	47.6	59.6	67.7	72.8	70.6	64.2	49.6	39.6	24.4	48.8
Williamstown	30.2	29.4	28.3	44.7	55.8	64.6							
Woods Holl	35.8	34.5	34.2	43.6	52.6	61.2	67.6	67.8	63.5	52.2	43.1	29.2	48.8
Worcester	29.9	32.8	31.2	46.2	58.8	64.5	69.5	67.4	60.5	47.2	37.7	21.1	47.2
Michigan:													
Adrian	32.6	32.2	31.0	47.4	55.1	71.5	71.8	67.0	59.3	50.9	40.9	26.2	48.8
Albion[4]	32.9	32.8	30.2	48.2	55.3	72.5	72.9	66.8	58.6	49.9	40.5	28.2	49.1
Allegan								65.8	60.0	49.7	40.5	27.8	
Alma	28.2	27.4	27.0	44.5	52.3	70.6	69.6	64.6	59.2	49.1	38.9	25.4	46.4
Alpena	24.6	24.0	22.2	38.8	45.5	63.4	65.6	60.9	55.9	46.1	35.4	24.0	42.2
Ann Arbor	32.4	31.7	29.2	46.5	54.0	71.9	72.4	66.5	60.3	49.1	39.7	25.3	48.2
Atlantic	12.6	13.3	14.4	32.7	38.7	59.1	62.1	56.9	55.0	38.5	31.2	22.2	[36.4]
Ball Mountain	30.0	29.0	27.6	44.0	52.3	68.8	68.9	63.7	57.0	38.5	37.6	23.8	45.1
Bangor	34.0	34.1	30.1	48.0	57.2	75.3	73.7	68.3	61.0	52.3	40.7	28.9	50.1
Bear Lake	25.9	25.3	23.2	37.9	48.6	67.8	66.6	60.7	56.1	47.7	36.2	23.5	43.3
Bell Branch	31.3	30.5	29.7	42.8	52.1	71.0	72.1	63.5	[59.0]	49.6	39.6	25.9	[47.3]
Benton Harbor	36.7	37.5	33.0	50.2	57.1	74.5	73.9	69.2	62.2	54.0	44.5	32.6	52.1
Benzonia	26.2	26.6	24.2	41.2	47.2								
Berlin	31.5	33.8	27.9	44.6	53.4	71.7	71.4	66.6	60.5	50.2	38.1	29.3	48.2
Berrien Springs[4]	33.4	33.4	29.4	47.8	55.1	72.6	70.6	66.9	58.4	51.2	42.6	31.1	49.4
Big Rapids	26.9	28.0	25.0	44.3	50.2		69.4						
Birmingham	33.1	32.5	30.2	46.7	53.2	71.6	71.3	64.0	58.1	50.0	39.4	25.5	48.0
Bronson	30.2	29.8	26.4	45.4	54.3	72.3	72.4	64.8	53.5	45.4	35.7	24.0	46.2

Buchanan	32.0	33.1	29.4	48.0	54.7	70.6	-------	-------	-------	-------	-------	-------	-------
Calumet	17.0	17.5	19.4	37.2	41.2	61.9	63.2	59.1	52.3	43.8	32.2	21.6	38.9
Caldwell (Manton)	26.2	24.7	22.2	40.0	47.5	69.5	68.0	61.0	55.1	45.0	34.0	23.0	43.0
Cassopolis	32.3	34.3	30.7	48.1	55.1	72.5	72.9	67.6	56.1	50.6	41.9	29.4	49.3
Charlevoix	22.6	22.8	22.0	39.9	45.9	65.4	67.7	62.5	58.1	48.6	37.3	25.8	43.2
Chase	25.4	26.8	22.7	43.9	49.6	69.0	-------	-------	-------	-------	36.3	-------	-------
Cheboygan	[22.0]	[20.0]	[20.0]	38.1	45.0	63.5	65.6	61.4	55.6	45.2	32.8	22.0	[40.9]
Chelsea	35.3	32.8	34.1	48.5	53.7	70.0	72.6	65.0	57.6	49.7	[41.0]	24.9	[48.8]
Clinton	33.0	32.2	30.4	46.8	55.6	72.3	71.9	69.4	59.3	49.8	40.3	25.4	48.9
Colon	30.4	30.6	26.5	45.6	52.8	69.3	69.8	63.9	55.6	47.0	37.4	25.2	46.2
Columbiaville	31.4	31.3	28.4	48.4	-------	-------	-------	67.4	-------	-------	-------	-------	-------
Concord	32.1	32.6	28.6	46.8	54.7	70.5	70.9	65.2	57.2	48.6	38.5	25.3	47.6
Crawford	-------	-------	-------	43.8	50.9	-------	69.3	63.7	-------	-------	-------	-------	-------
Crystal Falls	13.7	17.2	19.9	39.2	43.6	65.2	65.4	57.5	53.1	42.8	30.6	19.5	39.0
Detroit[4]	33.6	32.4	30.4	46.5	54.6	71.6	72.2	67.0	59.8	51.6	41.3	27.3	49.0
Detroit[5]	-------	-------	-------	48.9	57.3	73.8	74.6	70.0	-------	-------	-------	-------	-------
East Tawas	28.2	28.4	26.8	42.1	49.1	67.0	-------	-------	-------	-------	-------	-------	-------
Eden	31.7	31.3	28.5	47.9	54.9	71.7	72.2	66.0	58.6	50.2	39.1	25.8	48.2
Escanaba	19.6	21.2	21.4	38.0	44.4	65.4	67.1	62.4	55.1	47.1	35.4	24.1	41.8
Evart	22.3	26.7	21.6	35.9	48.3	66.2	68.9	60.2	[56.0]	47.1	35.0	21.3	[42.5]
Fairview	-------	-------	-------	44.3	51.9	71.0	70.6	63.1	58.4	-------	39.1	29.5	-------
Fitchburg	-------	-------	-------	-------	53.8	70.8	70.6	64.0	57.1	48.8	39.1	24.8	-------
Flint	30.3	30.2	27.7	44.5	53.9	70.2	72.2	64.5	58.8	[49.0]	[39.0]	24.5	[47.1]
Fort Brady	17.3	17.8	17.8	h36.2	[43.0]	61.3	63.2	59.2	54.5	45.6	32.4	21.0	[39.1]
Fort Mackinac	22.0	21.5	20.0	37.0	42.8	60.4	63.5	59.5	53.2	46.2	34.2	23.0	40.3
Fort Wayne	33.4	33.1	30.8	46.4	54.7	72.2	72.0	66.6	59.0	51.1	40.8	26.2	48.9
Fremont	27.1	29.1	25.0	42.2	51.6	70.2	68.9	64.1	58.4	48.1	38.1	26.0	45.7
Gaylord	20.0	20.8	17.1	36.6	42.8	63.6	[67.0]	56.8	52.3	41.6	33.5	20.9	[39.4]
Gladwin	27.4	28.4	22.1	43.3	51.8	67.4	[68.0]	[61.0]	[58.0]	48.1	38.9	23.0	44.8
Grand Haven	30.6	30.8	28.4	44.2	50.4	68.0	68.0	63.8	57.8	49.8	40.4	29.6	46.8
Grand Rapids	30.9	30.2	26.4	45.3	53.3	71.8	71.9	66.3	59.2	50.8	39.8	27.0	47.7
Grape	35.0	34.2	30.8	47.4	55.6	70.9	71.7	68.2	60.5	51.0	41.6	28.1	49.6
Grayling	24.5	26.2	18.1	41.8	49.5	69.1	67.6	61.0	54.7	44.5	35.2	23.2	42.9
Gulliver Lake	19.7	19.9	20.8	37.4	44.1	64.3	63.8	60.3	52.9	46.8	33.7	23.7	40.6
Hanover	36.2	34.2	31.4	46.1	52.8	70.7	71.9	67.2	58.8	50.9	42.6	29.0	49.3
Harbor Springs	-------	-------	-------	-------	50.3	68.8	65.0	62.0	55.9	47.4	36.0	27.3	-------
Harrison	i23.9	24.0	22.1	42.4	49.5	69.5	69.3	62.3	56.1	46.2	34.0	21.7	43.4
Harrisville	25.1	25.3	23.1	37.7	44.4	61.6	65.8	61.3	55.9	46.2	35.7	22.8	42.1

[1] Dr. E. U. Jones. [2] A. F. Sprague. [3] Taunton water works. [4] Signal Service. [5] Rev. J. E. Terborg.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Michigan—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
Hart	31.8	32.5	27.0	43.7	49.1	69.5	66.6	69.3	55.5	51.9	41.1	32.8	47.6
Harrisville													
Hastings	31.3	31.4	28.6	46.6	53.9	71.9	71.1	66.4	57.9	49.4	39.9	27.6	48.0
Hayes	30.3	30.5	28.3	45.6	54.0	68.4	68.4	63.2	57.6	48.1	39.5	26.7	46.7
Highland Station	30.2	30.3	27.7	44.8	53.7	69.6	71.5	64.2	55.9	48.1	37.3	21.7	46.2
Hillman	24.6	21.8	20.1									23.9	
Hillsdale	33.1	33.2	30.6	49.1	56.5	71.3	72.9	66.7	59.2	50.8	39.3	26.2	49.2
Howell	[30.0]	[31.0]	[31.0]	44.2	51.5	70.6	71.0	65.2	58.0	49.5	39.7	24.5	[47.2]
Hudson	29.2	30.9	29.6	48.9	54.8	69.6	78.0	62.7	55.3	47.6	37.5	24.8	47.4
Ionia	30.6	34.2	26.8	45.0	51.5	67.6	71.0	63.4	[58.0]	47.6	41.6	27.7	[47.1]
Ivan	23.8	24.9	22.7	39.1	49.6	69.5	69.2	61.4	56.8	46.3	35.1	23.4	43.5
Jackson								64.6	56.2	49.1	a40.3	29.2	
Jeddo	30.5	28.9	26.9	42.9	52.2	71.9	72.4	66.3	60.3	50.1	39.5	28.0	47.5
Kalamazoo	31.2	34.0	30.2	49.4	55.6	69.0	72.3	67.2	60.4	51.0	43.4	29.1	49.4
Lansing[1]	31.2	31.0	28.2	46.6	53.8	71.2	71.6	65.4	58.3	49.4	39.3	26.4	47.7
Lansing[2]	31.6	31.9	28.5	46.8	53.6	70.6	71.4	65.0	57.5	48.7	39.0	27.2	47.6
Lathrop	17.5	19.4	18.5	38.3	45.1	68.0	67.4	61.5	53.7	45.6	32.2	21.4	40.7
Madison	33.4	33.0	28.5	48.5	56.8	72.9	72.1	67.0	59.0	50.6	40.6	26.4	49.1
Manistee	27.3	28.0	25.4	41.8	47.9	65.6	67.0	62.6	57.0	48.2	38.3	27.8	44.7
Manton	26.2	24.7	22.2	40.0	47.5	68.4	67.5	60.7	55.7	44.3	34.0	23.6	42.9
Marquette	18.8	20.3	20.8	39.2	42.2	61.8	65.2	60.2	55.0	45.4	34.0	23.1	40.5
Marshall	32.0	32.1	28.9	47.7	54.3	71.9	72.8	66.9	57.9	48.3	39.0	25.7	48.1
May	29.4	29.7	26.5	44.2	51.3	69.7	70.5	65.1	58.0	50.0	39.1	26.2	46.7
Mio	24.5	23.7	21.8		48.2			60.2			35.4		
Montague	28.3	28.9	25.4	42.2	48.9	66.9	66.6	73.2	57.0	50.2	38.4	26.8	45.2
Mottville	32.9	33.8	30.4	49.6	55.9	72.1	72.1	67.8	59.4	50.2	38.4	26.7	49.1
North Marshall	31.3	28.9	27.3	33.9	51.1	69.1	68.6	66.1	[58.0]	47.8	37.4	23.8	[46.1]
Olivet	30.1	31.0	27.4	45.5	52.2	68.8	69.1	63.5	56.8	47.4	38.4	25.6	46.3
Otsego	31.0	31.8	28.8	48.6	54.5	71.6	71.6	66.5	58.9	49.4	39.4	27.2	48.3
Ovid	30.4	30.4	27.7	45.1	52.8	71.0	71.8	65.1	57.4	49.0	38.2	25.0	47.0
Paw Paw	33.3	33.8	28.7	48.3	54.3	74.4	71.7	67.0	60.0	49.5	40.3	27.6	49.1
Pontiac	33.0	32.0	29.4	45.6	52.8	69.2	70.8	64.9	58.9	50.6	40.9	28.0	48.0

Port Huron	32.1	30.0	27.8	43.0	50.8	67.4	69.5	64.6	58.7	49.9	39.4	26.0	46.6
Pulaski	31.7	31.1	28.1	44.8	52.3	70.8	72.6	66.3	58.9	47.9	39.5	26.2	47.5
Rawsonville	34.5	33.6	30.5	48.0	55.7	72.4	72.3	66.7	59.6	51.2	43.4	28.1	49.7
Romeo	30.1	32.6	30.1	43.0	52.4	69.4	72.2	[66.0]	56.4	49.2	37.9	25.2	[47.0]
Roscommon	23.4	24.8	20.8	40.8	47.8	67.8	66.3	59.4	54.6	45.0	33.4	21.4	41.3
St Ignace	21.8	19.6	19.8	37.1	44.1	60.6	64.8	60.2	54.4	45.4	33.3	23.3	40.4
St. Johns	29.4	28.4	28.2	45.4	51.1	72.0	71.4	65.5	58.4	50.3	39.4	26.0	47.1
Sand Beach	27.9	27.3	24.8	39.8	47.5	64.5	66.8	63.7	56.6	46.9	37.6	24.1	44.0
Sault de Ste. Marie	17.6	16.2	17.8	37.0	43.4	61.3	62.8	58.6	54.1	45.6	31.8	19.0	38.8
Standish	----	----	----	----	----	----	70.6	62.5	57.9	49.0	33.0	22.0	----
Stanton	30.9	28.4	27.0	43.6	50.4	69.6	70.0	63.0	56.9	46.4	37.1	24.2	45.6
Thornville	32.9	31.4	28.3	46.0	53.7	71.7	72.2	65.6	58.6	50.0	39.5	26.8	48.1
Vandalia	31.1	32.2	29.2	47.8	53.9	71.7	72.6	67.3	59.2	50.6	41.4	28.4	48.8
Washington	30.0	30.8	28.8	46.1	51.1	68.7	69.7	64.4	58.0	50.1	39.8	25.2	46.9
Weldon Creek	26.8	29.0	24.7	43.7	49.4	68.1	68.2	62.7	56.9	47.1	37.0	25.7	44.9
West Branch	24.4	26.9	23.1	42.6	49.2	68.5	68.1	63.2	56.1	47.0	35.4	22.2	43.9
Williamston	35.3	33.6	31.0	48.5	54.9	70.0	70.5	66.1	59.5	50.9	42.6	33.4	49.7
White Pigeon	----	----	----	----	----	71.9	70.8	65.4	56.7	47.9	----	26.0	----
Ypsilanti[1]	30.8	30.8	28.1	43.8	52.2	68.5	67.4	62.3	55.2	47.1	36.9	23.0	45.5
Ypsilanti[3]	33.0	33.2	31.6	46.8	53.0	69.5	69.8	64.8	56.6	49.4	37.4	25.4	47.5
Minnesota:													
Crookston	2.1	−2.6	17.1	43.4	47.3	67.8	69.4	64.7	52.6	43.2	30.8	18.1	38.3
Duluth	12.2	16.6	21.6	40.6	43.2	57.5	66.3	60.7	55.1	45.0	34.4	22.6	39.6
Farmington	[10.0]	19.2	23.4	48.1	52.7	69.3	71.0	65.2	56.6	45.1	34.7	24.0	[43.3]
Fort Snelling	10.9	19.9	22.3	48.3	51.4	69.2	71.0	63.9	56.7	44.0	32.6	21.7	42.7
Grand Meadow	[12.0]	[20.0]	18.5	42.6	50.1	70.4	73.2	61.3	53.7	43.4	31.4	20.5	[41.4]
Lake Winnebigoshish Dam	3.1	8.5	15.9	41.2	47.2	67.1	68.0	60.4	52.9	41.6	30.0	16.9	37.7
Leech Lake Dam	3.2	9.2	15.3	41.3	46.3	67.7	67.6	60.5	52.4	41.4	29.4	16.5	37.6
Le Sueur	9.8	*d*17.2	23.1	*d*49.6	56.1	70.5	73.8	*e*66.4	59.8	*d*46.2	*c*34.9	*d*24.5	44.3
Mankato	12.6	20.9	25.9	50.3	54.7	69.9	72.2	64.8	58.2	47.7	36.8	26.7	45.1
Medford	[10.0]	[19.0]	20.9	46.4	51.7	67.8	71.0	63.7	55.3	44.3	*g*33.6	[24.0]	[42.3]
Minneapolis	9.6	17.5	22.2	47.5	51.5	69.2	71.0	64.1	56.0	44.5	34.0	23.3	42.5
Montevideo	3.5	14.2	22.7	49.6	52.4	68.5	71.0	64.7	59.1	46.1	34.6	23.7	42.5
Moorhead	−0.9	4.8	18.2	44.6	48.0	67.6	69.2	62.7	54.6	44.8	32.6	19.1	38.8
Morris	3.8	10.9	20.9	48.0	50.9	69.4	71.2	64.2	56.7	44.0	31.8	21.4	41.1
Northfield	11.0	19.4	22.8	47.8	52.6	68.8	71.6	64.4	56.7	45.0	34.2	23.7	43.2
Owatonna	10.2	18.7	21.9	*f*46.0	----	----	----	----	----	----	----	----	----

[1] Signal Service. [2] Dr. H. B. Baker. [3] Medical department.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Minnesota—Continued.													
Pine River	2.0	6.6	16.7	41.7	46.9	67.4	69.7	61.0	53.2	40.8	29.6	15.2	37.6
Pokegama Falls	3.3	9.4	15.6	40.9	45.2	65.8	67.6	59.1	50.5	40.4	29.3	15.5	36.9
Red Wing	14.3	22.2	23.8	48.8	53.7	69.7	72.1	65.0	58.4	47.2	37.1	[24.0]	[44.7]
Rolling Green	9.0	16.2	21.3	44.9	53.7	69.1	72.5	65.7	d58.1	44.9	33.3	22.6	42.6
St. Charles	12.4	19.5	20.4	34.8	50.4	67.0	69.0	64.0	55.8	42.0	35.2	25.6	41.3
St. Paul	9.9	18.5	22.4	47.8	52.2	69.8	71.9	65.0	58.2	46.4	35.6	24.0	43.5
St. Vincent	—10.0	— 3.2	11.8	41.4	45.2	68.8	68.8	60.1	51.3	42.0	28.4	19.0	35.3
Sheldon	13.4	21.0	22.4	47.8	54.2	71.4	73.7	65.2	54.0	44.2	32.0	21.2	43.4
Mississippi:													
Aberdeen	------	------	------	------	66.5	77.6	77.5	74.8	69.9	58.4	52.9	------	------
Agricultural College	53.8	56.0	52.3	64.7	70.5	81.6	81.2	77.8	70.3	63.2	58.3	48.8	64.9
Batesville	53.1	50.2	51.7	63.5	70.2	80.5	80.6	78.2	71.6	62.0	54.2	46.6	63.6
Bay St. Louis	------	------	------	------	------	------	------	------	78.6	h70.0	64.6	52.7	------
Booneville	58.2	57.8	52.5	62.8	69.0	81.0	81.1	[78.0]	70.0	[61.0]	59.1	g52.2	[65.2]
Brookhaven	62.4	61.2	57.7	65.8	72.1	79.4	81.6	79.6	75.2	66.0	60.4	51.9	67.8
Canton	[56.0]	[57.0]	[55.0]	66.0	69.9	78.4	80.0	77.8	73.4	62.5	57.9	50.2	[65.4]
Columbus[1]	55.2	57.5	52.9	63.2	72.2	------	82.8	f80.0	75.2	------	------	------	------
Columbus[2]	55.2	57.5	52.9	65.6	71.0	84.0	83.4	80.1	75.0	63.0	57.6	[49.0]	[66.2]
Corinth	------	------	------	------	70.4	79.0	79.4	78.0	70.6	61.6	56.6	------	------
Edwards	58.0	58.1	56.8	67.8	73.2	81.9	83.0	80.6	75.6	54.6	59.4	50.3	67.4
Enterprise	------	------	------	------	------	------	------	------	73.1	62.0	57.4	49.8	------
Fayette	59.8	60.8	56.7	68.2	72.6	79.9	81.2	78.1	74.4	65.6	[60.0]	54.2	[67.6]
Greenville	55.8	[55.0]	57.8	l66.8	73.5	82.0	83.6	80.4	73.7	63.2	46.9	49.0	[66.6]
Hattiesburg	------	------	------	69.8	74.0	78.6	81.9	80.0	77.5	68.8	62.8	56.1	------
Hazlehurst	------	------	------	------	72.8	79.6	81.2	79.7	74.6	66.1	60.2	------	------
Hernando	------	------	------	------	65.3	76.0	75.8	73.7	66.8	59.8	55.1	------	------
Holly Springs[3]	d50.6	53.0	48.2	62.0	69.1	80.6	80.2	78.4	72.7	61.0	57.5	46.9	63.4
Holly Springs[1]	------	------	------	------	69.2	80.4	80.6	76.2	69.9	60.6	54.4	------	------
Jackson	55.8	f55.7	[55.0]	[65.0]	72.0	80.8	82.3	80.0	75.5	65.2	59.2	[50.0]	[66.4]
Kosciusko	56.2	57.4	54.2	64.8	69.1	78.8	79.7	76.0	72.5	61.9	58.0	48.4	64.7
Lake	57.2	58.4	54.6	64.0	69.6	78.8	80.0	77.0	71.6	58.2	50.6	[48.0]	[64.1]
Logtown	64.5	64.0	61.0	68.9	73.4	79.6	79.9	79.0	76.8	67.0	61.6	53.6	69.1

Louisville	55.8	58.3	53.5	64.6	70.1	80.4	82.6	78.9	73.8	62.8	57.8	49.0	65.6
Macon	*g*62.8	[64.0]	67.2	57.2	73.6	78.6	78.3	75.4	71.8	63.8	58.6	[49.0]	[67.5]
Meridian	57.8	58.0	54.0	65.1	70.0	79.4	80.0	77.3	73.2	62.7	57.8	49.6	65.4
Moss Point	63.4	63.4	60.0	70.4	73.9	82.3	82.6	81.6	78.8	67.4	62.4	54.8	70.1
Natchez[4]	------	62.7	57.6	67.0	72.0	79.0	81.4	79.6	------	------	------	------	------
Natchez[1]	------	------	------	------	72.5	80.5	82.6	80.7	75.5	65.6	60.3	------	------
Okalona	------	------	------	------	70.6	82.2	82.4	78.7	74.2	61.6	56.4	------	------
Palo Alto	54.6	56.8	52.2	64.2	68.5	80.1	80.0	76.7	71.8	61.0	59.6	48.4	64.5
Pearlington	64.5	63.4	60.3	68.9	73.4	81.5	81.7	79.0	76.9	67.9	61.7	54.8	69.5
Pontotoc	54.1	53.3	50.7	61.8	66.2	76.5	77.4	76.9	70.0	58.6	53.8	46.4	62.1
Port Gibson	60.0	59.3	56.8	66.7	71.2	79.4	81.4	79.2	74.4	63.4	58.2	[54.0]	[67.0]
Rienzi	[54.4]	54.9	51.3	63.8	69.8	80.7	82.2	75.2	72.6	61.1	56.4	49.0	[64.3]
Summit	*d*58.8	60.0	56.1	*f*64.8	------	------	------	------	------	------	------	------	------
University	52.2	54.2	50.0	62.8	68.9	79.5	80.8	77.2	71.8	61.3	56.4	46.4	63.5
Vaiden	[56.0]	58.4	51.4	66.5	71.2	81.8	82.5	79.0	73.1	62.0	56.6	47.2	[65.5]
Vicksburg	59.2	60.0	56.8	67.2	71.7	79.9	82.6	80.0	74.9	64.8	60.4	52.4	67.3
Washington	61.2	61.2	58.4	69.0	72.6	79.8	81.7	79.6	74.8	65.2	59.2	52.8	68.0
Water Valley	54.5	56.1	53.2	66.0	72.2	81.6	83.5	78.8	73.6	63.6	57.6	48.2	65.7
Waynesboro[5]	58.2	58.1	56.2	65.9	72.0	80.2	82.1	78.4	73.8	62.0	56.9	48.5	66.0
Waynesboro[2]	------	------	------	------	72.8	79.4	81.4	79.6	75.8	60.6	58.8	------	------
West Point	[55.0]	[57.0]	54.0	64.6	69.7	81.4	81.2	78.0	73.5	61.8	58.3	48.3	[65.2]
Missouri:													
Adrian	------	------	------	------	------	76.6	77.5	70.9	60.1	51.0	41.8	32.8	------
Appleton	34.2	37.5	39.9	56.4	62.4	*f*78.4	[80.0]	[72.0]	64.4	55.6	45.7	36.5	[55.2]
Austin	------	------	------	------	------	78.4	81.8	75.0	65.4	57.4	46.8	37.4	------
Bethany	------	------	------	52.1	53.1	80.1	77.6	72.8	62.4	50.6	39.8	34.8	------
Bradleyville	------	------	------	------	------	79.4	85.4	78.9	------	59.7	------	------	------
Brunswick	30.6	33.4	36.7	55.7	63.1	76.9	79.2	72.0	62.9	55.1	43.4	36.3	53.8
Carrollton	30.0	34.0	33.0	55.0	60.0	75.2	77.8	71.2	61.7	53.8	44.0	34.4	52.5
Carthage	39.1	40.0	43.0	58.7	63.8	75.2	70.8	[73.0]	[64.0]	57.0	46.8	39.5	[55.9]
Cassville	------	------	------	------	62.4	73.8	77.0	73.4	64.9	*g*53.8	*d*48.3	38.0	------
Columbia	36.2	37.6	37.0	56.8	63.3	77.2	79.0	72.3	63.5	56.1	47.2	37.4	55.3
Conception	24.3	29.0	33.4	53.9	62.3	76.4	79.0	71.2	60.1	53.4	43.1	34.5	51.7
Concordia	------	------	------	------	------	------	92.0	83.1	73.6	68.0	55.0	44.6	------
Craig	24.0	28.3	32.5	------	61.6	75.6	------	------	------	------	------	------	------
Dadeville	------	------	------	------	------	------	------	78.9	67.4	60.4	51.4	42.0	------
Eldon	------	------	------	------	67.2	81.2	81.8	76.6	65.7	58.1	48.6	38.2	------
Excelsior Springs	27.9	31.0	33.7	54.6	60.2	74.8	76.8	71.0	60.9	52.9	40.2	31.4	51.3

[1] Miss H. Quinche. [2] Cotton Belt Observer. [3] Dr. F. B. Shufford. [4] W. H. Swan. [5] W. S. Daries.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Missouri—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
Fayette	33.4	36.1	36.4	56.0	62.8	77.1	79.5	73.6	63.6	55.2	44.8	35.0	54.5
Fox Creek	36.6	36.4	36.4	54.9	62.1	75.9	76.1	71.6	62.9	53.7	42.6	34.6	53.6
Fortescue	27.2	30.7	34.6	56.6	61.5	76.2	79.3	72.4	63.7	53.2	42.2	34.5	52.7
Frankford	29.2	31.7	g32.4	48.5									
Glasgow	32.3	34.6	36.1	55.6	62.3	76.4	79.2	72.2	62.7	55.2	45.0	36.0	54.0
Glenwood						g76.7	78.4	69.8	e65.0		42.6		
Grand Pass	31.0	34.2	36.5	56.2	62.9	76.3	78.4	71.9	63.4	55.8	44.6	31.9	53.6
Harrisonville	28.4	31.0	33.0	51.2	58.2	75.0	75.4	68.8	63.5	54.6	43.3	35.1	51.5
Hermann								73.8	64.9	56.4	41.8	36.0	
Ironton	42.9	42.0	42.5	58.0	65.1	77.6	78.0	73.1	64.9	58.1	[50.0]	[37.0]	[57.4]
Jefferson Barracks	39.5	42.1	39.4	57.1	63.8	77.9	83.8	73.6	65.0	57.1	48.7	37.7	57.1
Kansas City[1]	30.2	34.0	38.3	57.0	63.6	77.0	80.5	73.7	63.2	56.2	46.4	37.4	54.8
Kansas City[2]	29.4	34.2	38.2	57.0	64.6	77.9	81.1	74.4	64.6	56.3	45.4	36.9	54.0
Kidder[3]							80.9	74.0	59.2	e50.6	40.0		
Kidder[4]						81.2	80.7	72.5	66.0	60.5	55.0	50.9	
Kirksville	29.1	29.8	29.5	51.2	56.0	70.9	77.6	66.2	57.4	49.8			
Lamar					63.6	75.9	80.0	73.5	64.0	56.8			
Lamonte	34.6			58.0	66.8	80.9				60.1	45.7	35.4	
Lebanon	40.0	42.0	43.2	57.0	65.6	79.0	80.3	76.1	65.4	58.2	51.4	43.1	58.4
Liberty	29.0	32.8	36.4	56.1	63.8	78.7	81.5	[74.0]	63.5	54.6	43.2	34.6	[54.0]
Marshfield	42.5			57.7		80.0		75.2	64.0		49.4		
McCune Station							82	80	80.5	60.2	65	40	
Miami[5]	31.0	34.4	35.4				80.1	d73.0	64.2				
Miami[6]	32.8	34.1	35.9	56.9	64.8	79.9	80.8	73.7	64.2	55.6	49.0	39.5	55.6
New Frankfort	31.0	34.6			62.4	76.0	78.7	72.2	62.3	55.0			
New Haven	37.8	38.0	37.6	57.2	63.8	80.1	81.2	74.9	65.1	55.6	44.8	34.6	55.9
Oak Ridge	47.4	42.0	41.0	57.9	67.8	76.5	81.0	73.9	66.3	60.3	d55.6	38.9	59.0
Oregon	22.6	29.3	34.3	56.5	60.9	76.8	79.6	72.3	63.0	54.4	43.6	35.6	52.4
Ozark	40.0	40.3	41.6	59.2									
Pickering					j54.6	71.7	74.9	61.5	52.8	40.2	36.5	27.8	
Platte River	27.0	31.1	36.9	56.4	62.1	76.8	80.9	75.0	62.8	54.7	43.8	35.5	53.6
Princeton	27.8	31.7	33.6	55.8	62.4	75.3	79.4	73.0	64.5	55.2	43.6	35.7	53.2

St. Charles[7]	33.1	42.5	37.7	56.3	57.4	74.9	80.0	73.0	66.5	53.8	47.4	37.1	55.0
Sarcoxie					62.6	75.0	77.2	73.4	64.2	55.8	46.6	39.5	
St. Louis[1]	39.2	40.2	39.0	57.2	63.8	79.4	79.8	74.7	65.0	57.3	48.6	37.6	56.8
Sedalia	33.3	37.4	37.7	56.4	64.0	80.5	80.0	74.0	64.6	57.0	46.3	37.3	55.7
Springfield	39.4	40.2	42.6	58.2	64.6	75.6	78.2	73.6	63.4	56.3	48.2	40.0	56.7
Steelville	39.8	39.7	39.1	56.5	[65.0]	[78.0]	[80.0]	71.2	62.2	54.2	45.4	35.4	[55.5]
Stellada					63.7	76.7	79.4	73.0	64.2	57.2	46.2	37.8	
Warrensburg	30.4	32.8	36.2	54.5	62.0	76.3	79.8	72.2	63.3	55.3	49.2	36.6	54.0
Warrenton	34.0	33.6	35.4	56.4	64.8	79.6	82.1	[74.0]	g62.6	d51.3	h45.0	33.0	[54.3]
Willow Springs	42.2	43.6	43.5	59.6	68.4	76.9	78.2	72.8	64.2	57.1	50.4	37.1	57.8
Windsor	36.2	34.7	36.4	59.1	63.7	76.7	79.2	72.9	64.7	53.3	46.8	34.3	54.1
Montana:													
Blackfeet Agency	[5.0]	[10.0]	c31.8	c40.6	50.6	57.0	64.8	60.2	50.8	43.4	40.0	31.8	[40.5]
Camp Poplar River	−7.5	−0.1	22.2	45.6	51.8	63.9	71.4	65.7	56.5	45.0	35.3	26.4	39.7
Choteau						58.2	67.0	62.2	54.0	45.6	42.8	35.1	
Fort Assinniboine[1]	−5.1	2.8	27.6	44.8	52.6	62.2	70.6	64.8	55.6	45.6	40.6	29.8	41.0
Fort Assinniboine[3]	−4.0	1.3	27.7	44.0	53.7	61.1	70.2	64.8	55.6	45.6	40.6	30.4	40.9
Fort Custer[1]	4.8	17.6	35.4	45.4	55.4	63.0	74.2	68.6	58.4	48.4	39.9	31.4	45.2
Fort Custer[3]	4.5	17.6	35.4	45.4	55.5	63.0	74.2	68.9	58.4	48.9	39.9	31.2	45.2
Fort Keogh	0.5	10.3	30.6	46.2	54.4	65.0	73.3	68.6	55.6	44.2	35.9	22.6	42.3
Fort Logan	1.8	9.4	30.8	45.2	49.0	54.4	63.0	60.6	51.4	41.0	[40.0]	[30.0]	[39.7]
Fort Maginnis	11.9	15.7	31.8	45.6	51.0	h55.8							
Fort Missoula	13.2	18.2	34.0	45.2	56.1	56.8	67.0	64.8	55.6	42.7	33.1	31.0	43.1
Fort Shaw	10.8	14.2	35.9	45.3	55.0	60.4	70.0	64.7	56.8	49.1	41.7	36.2	45.0
Glendive	−0.3	8.4	29.4	49.2	56.6	69.8	76.3	72.3	60.2	48.2	38.8	29.4	44.9
Helena	7.2	16.8	35.3	45.6	54.0	58.9	70.6	66.8	57.4	46.2	37.4	30.2	43.9
Martinsdale	7.3	15.0	31.0	42.4	52.0	58.8	69.2	67.2	55.2	42.3	38.0	32.4	42.6
Powder River	3.7	12.3	33.4	46.2	55.0	64.8	74.4	70.6	57.8	45.5	36.4	24.6	43.7
Sheldon	15.0	19.4	36.4	46.6	58.6	60.5							
Virginia City	12.2	18.0	32.0	41.9	51.0	54.3	67.8	62.5	53.3	39.9	35.0	29.4	45.4
Nebraska:													
Alliance	[15.0]	[25.0]	[35.0]	49.8	54.6	67.3	74.6	68.2	58.7	45.6	35.5	31.6	[46.7]
Ansley	15.5	25.4	33.0	51.0	58.5	71.1	78.9	72.2	62.3	48.8	38.6	32.5	49.0
Ashland		27.4		57.2	65.0	75.2	79.9	76.8	60.5	51.9			
Bassett						71.2	76.1	69.2	62.3		34.0	31.7	
Beaver City									64.6	52.0	42.1	k37.3	
Bingham	15.2	22.1	32.2	46.6		64.9							
Creighton	12.0	21.4	27.5	48.4	55.2	[71.0]	74.4	67.3	58.2	46.6	34.8	26.8	[45.3]

[1] Signal Service. [2] S. J. Spurgeon. [3] Medical department. [4] S. S. Stahl. [5] Robert Ruxton. [6] Dr A. W. Sullivan. [7] L. C. Saeger. [8] U. S. post hospital.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Nebraska—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
Crete[1]	18.9	26.9	33.6	54.6	59.8	74.2	79.4	72.4	63.8	53.2	42.2	34.5	51.1
Crete[2]	18.0	24.7	33.2	53.5	59.4	[74.0]	78.6	71.1	62.2	51.0	40.2	31.6	[49.8]
Culbertson[2]				48.3	58.6	80.8	86.6						
David City				42.0		64.8		66.6				24.6	
De Soto	16.8	24.8	30.8	54.6	59.0	72.8	77.5	70.0	61.1	50.5	39.7	31.6	49.1
Ericson									63.3	50.3	38.5	30.6	
Fairfield	11.9	[29.0]	34.0	53.4	57.6	77.5	78.9	71.2	62.4	50.8	41.5	30.2	[48.8]
Fort Niobrara	8.0	19.8	29.5	45.9	50.6	66.0	72.1	66.8	57.6	44.6	35.4	29.0	43.8
Fort Omaha	20.3	27.4	34.3	55.8	60.8	74.9	78.1	70.4	62.3	52.6	41.6	34.6	51.1
Fort Robinson	15.7	27.5	36.7	48.1	55.7	67.2	76.3	69.5	61.2	48.8	[36.0]	33.1	[49.6]
Fort Sidney	18.0	28.6	38.3	48.6	56.0	67.8	79.7	71.5	64.2	48.2	[37.0]	*f*31.0	[49.1]
Franklin	19.4	25.8	35.2	49.6	60.0					52.4	40.2	32.4	
Fremont	16.3	24.3	30.9	54.5	59.9	73.0	76.6	69.9	61.4	51.0	40.2	32.3	49.2
Genoa	14.6	22.7	31.6	53.0	59.7	72.8	78.6	71.0	62.2	50.5	39.8	30.7	48.9
Gering	[16.0]	27.1	37.4	47.6	55.3	68.4	77.0	70.3	63.0	49.4	40.2	36.1	[48.9]
Grand Island	15.8	22.9	28.2	48.7	[58.0]	[72.0]	75.3	64.9	57.2	45.3	35.7	24.2	[45.6]
Hay Springs	11.9	23.0	33.2	45.6	53.1	65.0	74.2	68.3	59.9	45.2	34.1	28.5	45.2
Hebron	[18.0]	[26.0]	[34.0]	56.2	63.9	75.5	80.5	72.5	64.3	53.3	40.8	33.8	[51.6]
Howe	20.6	28.4	33.4	59.4	63.9	76.4	81.1	74.3	64.5	55.6	42.2	34.8	52.9
Imperial						79.5	82.6		66.1	60.0	40.4	*n*32.5	
Kennedy	15.8	26.2	34.6	*f*48.8	[62.0]	68.6	75.1	69.5	63.3	49.0	38.2	32.6	[40.3]
Kimball	21.5	31.0	34.6	48.4	56.0	67.9	76.4	70.4	61.4	48.2	38.2	34.7	49.1
Lexington	18.4	27.2	31.9	[50.0]	57.8	70.8	82.2	74.4	62.7	51.9	40.0	34.4	[50.1]
Lincoln	18.6	25.4	32.3	54.0	62.0	74.5	79.2	71.2	62.7	52.8	41.7	33.6	50.7
Long Pine					62.1	73.1	83.2	72.7	58.5	49.8	49.0		
Minden	18.8	24.8	34.0	[49.0]	61.2	73.3	80.2	72.1	64.0	51.3	37.8	31.1	[49.8]
Nebraska City	19.3	25.5	32.8	56.7	60.5	73.9	75.4	70.0	61.3	49.7	41.7	33.6	50.0
North Loup	13.9	23.2	32.5	52.4	59.1	70.8	78.4	70.3	62.5	51.3	39.1	31.1	48.7
North Platte	18.8	27.2	36.4	49.9	58.1	69.6	77.4	71.4	63.0	50.9	38.8	34.3	49.6
Oakdale	10.9	21.3	29.9	52.3	58.0	71.1	76.9	69.4	61.1	48.4	37.3	27.2	47.0
Omaha	18.2	25.2	32.6	55.2	60.1	74.4	78.8	71.0	62.7	52.2	42.2	34.6	50.6
O'Neill							77.2	70.0	62.9	51.0	40.9	32.2	

Palmer	11.9	21.0	29.2	48.5	55.5	71.8	82.3	72.5	58.8	44.5	36.6	29.1	46.8
Ravenna	16.0	25.0	34.1	52.4	59.0	72.0	78.8	70.4	60.1	50.4	39.3	32.9	48.4
Syracuse	20.0	26.4	33.3	56.2	62.2	76.5	81.2	72.6	63.3	51.8	41.5	33.1	51.5
Tecumseh	19.4	26.3	33.0	56.9	60.2	76.1	79.6	70.8	61.8	52.2	41.1	e33.4	50.9
Tekamah	[16.0]	[25.0]	40.5	56.8	56.8	[73.0]	79.9	72.9	59.5	53.3	40.7	33.0	[50.6]
Valentine	11.0	23.0	32.2	50.0	55.2	68.8	75.6	69.3	61.9	48.7	38.4	32.2	47.2
Wallace									60.3	49.7	36.6	32.5	
Weeping Water	16.7	23.7	30.3	53.2	58.0	72.2	76.1	68.7	59.4	49.8	38.6	31.0	48.1
West Hill	13.8	21.0	33.4	49.1	57.1	70.1	77.0	70.0	64.6	48.0	36.5	30.0	47.6
Weston	17.3	30.0	32.2	52.2	60.5	70.6	80.4						
Whitman									62.2	48.7	38.2	30.7	
Thedford						78.4	82.0	75.3	74.4				
Nevada:													
Austin	21.3	29.6	36.8	45.4	55.1	58.6	70.8	66.4	60.4	45.6	40.2	33.5	47.0
Battle Mountain	18.0	33.9	44.2	55.2	[57.0]	69.6	83.3	75.3	66.5	51.7	38.2	34.4	[52.3]
Belmont	16.6	23.4	34.4	[51.0]	53.3	59.3	71.4	65.3	60.2	47.8	40.6	31.6	[46.2]
Beowawe	11.1	28.0	40.5	52.4	64.9	67.7	82.2	73.7	67.9	47.5	36.6	31.5	50.3
Browns	22.3	39.6	46.8	58.9	69.9	74.5	85.9	83.2	73.6	54.1	40.1	39.2	57.3
Candelaria	20.2	31.2	40.9	49.9	59.4	62.9	76.1	70.3	64.2	49.9	43.6	35.7	50.4
Carlin	8.8	23.2	34.6	54.2	58.8	59.8	78.1	69.9	57.9	41.1	27.2	23.6	44.8
Carson City[1]	21.0	33.0	40.6	48.7	57.0	59.0	67.3	66.2	60.5	48.2	39.2	35.2	48.0
Carson City[3]	18.9	31.9	39.7	49.8	58.4	62.3	71.9	68.1	61.1	47.4	37.0	33.2	48.3
Columbus Marsh	[22.0]	32.2	40.2	50.4	63.0	65.6	78.8	74.7	64.8	52.0	37.4	28.0	[50.8]
Downeyville	23.5	32.2	42.6	50.9	61.5	65.0	77.4	73.5	66.8	52.6	44.8	38.2	52.4
El Dorado Canyon	47.3	55.8	61.6	70.6	80.1	84.5	96.0	91.4	85.7	71.8	63.2	56.2	72.0
Elko[1]	[10.0]	24.7	36.9	46.3	57.2	59.5	74.0	71.6	60.6	[44.0]	32.2	30.7	[45.6]
Elko[3]	10.0	25.0	32.0	45.4	56.2		70.0	66.4					
Ely	19.0	35.6	38.2	42.6	55.4	59.2	70.8	63.0	52.0	42.2	37.3	25.6	45.1
Eureka	18.2	26.4	35.8	46.4	56.2	60.1	74.0					47.4	
Fenelon	16.5	28.8	36.5	[50.0]	61.5	65.9	84.3	82.7	65.3	52.7	36.3	31.6	[51.0]
Genoa	20.2	32.4	39.2	49.5	56.4	59.5	68.6	65.6	61.2	51.9	[40.0]	31.7	[48.0]
Golconda	16.5	32.8	41.5	45.9	62.3	69.0	85.0	73.8	63.6	51.2	34.5	33.2	50.8
Gold Mountain	25.4	34.4	42.2	51.8	60.3	65.8	77.5	72.4	k69.7	[48.0]	[39.0]	[33.0]	[51.6
Halleck[1]	13.4	22.1	36.6	50.2	59.2	63.9	75.4	69.8	55.9	40.3	29.2	27.0	45.2
Hartons Ranch	16.2	26.6	34.6	43.6	53.0	55.6	67.3						
Hawthorn			49.5							53.1	42.9	38.6	
Hawthorn	27.2	33.8	46.3	[50.0]	68.0	71.1	84.2	80.6	73.6	58.1	46.5	38.5	[56.5]
Hot Springs[1]	17.6	29.8	36.0	47.3	58.3	62.1	81.8	76.0	69.2	49.5	33.4	30.7	49.3

[1] Signal Service. [2] C. E. Chadsey. [3] Prof. Charles W. Friend.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Nevada—Continued.													
Hot Springs[1]	17.5	32.4	33.8	46.3	55.1	59.9	81.5	74.9	67.7	57.0	33.0	31.1	49.2
Humboldt	17.4	29.3	38.4	50.0	59.1	62.8	73.2	66.6	65.8	46.4	39.5	32.0	48.4
Lemers Ranch	22.8	30.6	38.5	49.4	57.6	57.6	71.2	67.9	65.2	52.2	42.3	34.7	49.2
Mill City	26.0		41.1				77.7	77.6	67.3	51.7	36.4	38.8	
Palisade	15.7	29.3	35.6	48.5	60.6	62.9	77.8	71.0	62.3	47.2	34.8	31.5	48.1
Palmetto	[25.0]	30.3	37.6	46.9	54.4	57.0	69.0	64.8	59.0	47.5	42.0	33.4	[47.2]
Pioche							70.7	64.2	57.1	40.2	33.0	29.7	
Punch Bowl			30.8	42.6	52.3	55.8	70.0	66.3	56.6	43.8			
Reno[2]	19.6	30.9	39.6	49.0	57.3	61.7	72.6	69.3		50.0	36.5		
Reno[3]	25.0	31.8	39.6	50.6	59.8	63.9	74.9	70.2	61.2	48.1	40.0	34.3	50.0
Ruby Hill	15.0	20.2	28.1	37.2	48.9	51.8	69.3						
Sodaville	20.5	34.0	45.0	53.4	63.9	67.8	82.1	76.4	68.6	[50.0]	[45.0]	[38.0]	[53.7]
Tecoma	13.9	26.5	36.4	54.8	64.3	65.1	82.3	76.0	65.5	41.3	31.7	23.9	48.5
Toano	15.1	28.0	37.1	50.7	64.1	64.1	77.0	71.9	[65.0]	[47.2]	39.6	[32.0]	[48.7]
Tuscarora	14.6	23.2	30.6	41.4		53.3	67.8	63.8					
Tybo							68.0	67.0	62.3	49.6	44.5		
Verdi	23.9	29.7	37.4	42.7	44.2	60.7	68.5	64.1	59.2	48.4	36.7	29.6	45.4
Virginia City	24.4	31.9	38.6	50.2	57.4	59.8	[67.0]	[66.0]	64.7	51.0	45.2	37.7	[49.5]
Wadsworth	21.3	33.4	42.3	55.7	67.7	67.7	80.7	77.4	67.1	49.6	38.9	35.4	53.1
Wells	15.2	29.6	37.8	50.5	60.5	67.1	77.0	75.9	67.3	43.9	32.4	33.0	49.2
Winnemucca[2]	14.7	30.6	38.8	48.5	58.1	60.2	71.6	68.8	60.1	46.5	37.6	32.3	47.3
Winnemucca[4]	19.3	36.5	[38.0]	43.8	64.8	65.4	80.6	69.3	62.9	50.5	34.4	27.1	[49.4]
Younts Ranch	40.8	45.7	53.6	61.8	68.3	72.4	83.6	80.4	74.0	60.0	52.0	47.3	61.7
New Hampshire:													
Berlin Falls	18.0	19.2	23.0	36.0	50.8	58.4	62.2	59.9	53.7	41.1	28.5	6.7	43.1
Berlin Mills	19.3	21.9	25.7	38.6	49.8	57.8	60.4	58.9	54.4	42.5	29.6	9.0	39.0
Concord	25.0	28.0	30.2	43.8	57.2	62.4	68.8	66.1	60.6	47.5	35.6	17.0	45.2
East Canterbury	20.4	22.6	28.4	41.9	56.9	63.0	70.1	65.7	58.4	47.0	31.8	15.4	43.5
Hanover[2]	23.0	25.4	27.8	41.5	54.3	63.5	69.5	64.6	57.3	44.6	32.6	12.4	42.9
Hanover[3]	21.6	25.3	27.9	41.5	54.7	63.1	67.0	65.7	59.7	42.8	34.2	11.8	42.9
Littleton								62.8	56.7	43.8	31.2	10.6	
Manchester[2]	26.0	28.2	30.8	44.4	57.0	63.1	68.6	66.6	60.9	47.8	36.6	19.2	45.8

Manchester[5]	26.6	29.6	32.1	44.8	56.8	64.5	70.4	66.8	60.9	47.4	37.0	19.3	46.4
Nashua	27.1	29.7	31.1	45.0	57.1	64.1	69.5	66.9	60.9	47.6	36.6	21.3	46.4
Newton	26.8	28.6	31.0	43.6	56.0	63.0	68.8	66.4	60.5	46.6	36.6	19.4	45.6
North Conway	20.0	22.8	28.6	41.7	54.1	61.0	65.6	64.3	57.8	45.6	32.4	12.1	42.2
North Sutton	23.0	23.9	27.0	40.6	52.7	60.2	66.3	63.1	57.2	44.4	33.4	13.9	42.1
Plymouth	17.2	21.6	27.0	40.2	53.8	63.2	66.3	67.2	58.1	44.4	30.9	12.0	41.8
Stratford	21.4	22.8	29.8	41.1	55.2	64.2	68.0	65.2	59.4	45.5	32.0	8.6	42.8
Walpole	25.4	25.8	26.1	42.0	54.0	62.4	66.1	64.1	58.1	44.6	33.1	15.0	43.1
West Milan	20.5	22.5	20.0	38.2	51.2	57.9	61.8	60.5	55.1	42.4	30.4	8.8	39.1
New Jersey:													
Allaire	40.9	39.6	37.8	49.2	54.4	67.0	69.8	69.0	64.3	52.9	42.8	31.4	51.6
Asbury Park	41.2	41.6	38.8	49.8	59.2	70.8	71.9	70.8	66.5	53.4	43.0	31.0	53.2
Atlantic City	42.1	41.2	38.2	47.7	57.0	68.9	70.8	71.0	65.5	55.6	46.0	33.6	53.1
Beverly	37.4	39.8	37.6	50.6	61.0	71.0	72.4	70.0	64.3	52.9	42.4	29.7	52.4
Billingsport L. H	40.7	40.7	38.2	51.1	64.1	76.1	76.6	74.3	67.7	55.0	44.3	31.2	55.0
Bridgeton	44.0	44.0	42.0	52.8	65.0	75.8	76.8	74.6	68.5	57.0	46.7	35.4	56.9
Cape May C. H	45.3	44.1	40.4	50.7	60.6	71.4	72.8	70.7	67.1	56.0	46.8	34.3	55.0
Egg Harbor City	42.2	40.9	38.5	50.0	59.4	70.2	71.6	71.0	64.8	53.5	43.7	32.5	53.2
Freehold	39.7	39.2	39.4	48.6	59.2	69.0	71.0	70.6	64.6	52.8	43.6	30.4	52.3
Gillette	37.6	36.3	35.0	51.3	58.8	68.4	70.8	70.0	62.3	51.4	42.6	27.8	51.0
Hanover	37.7	38.4	39.4	------	62.7	------	------	------	------	------	------	------	------
Highland Park	38.4	38.5	35.5	51.3	59.8	69.4	71.6	70.9	62.4	52.3	42.3	27.4	51.6
Imlaystown	41.0	39.8	38.3	48.6	58.5	69.7	71.4	70.4	64.4	54.4	44.2	30.1	52.6
Lambertville	40.4	40.0	36.7	51.0	61.1	70.2	70.7	70.4	65.2	51.5	42.7	30.0	52.5
Locktown	37.8	38.1	35.7	49.6	61.1	70.8	71.3	71.0	64.3	54.0	42.3	28.6	52.0
Madison	37.1	36.8	35.0	49.2	59.5	69.0	70.5	[74.0]	62.1	51.4	41.3	27.4	[51.1]
Moorestown	40.1	39.4	37.2	49.7	60.3	71.2	72.2	70.9	64.9	53.6	43.6	30.3	52.8
Newark	38.8	37.7	35.8	49.0	60.2	71.1	73.0	71.7	65.4	54.5	43.5	30.0	52.6
New Brunswick[2]	40.5	40.8	37.9	[50.0]	61.2	70.4	71.7	71.0	63.6	52.0	42.0	27.8	[52.4]
New Brunswick[3]	39.3	38.2	36.6	50.3	59.5	68.6	70.9	70.7	64.3	53.2	43.2	29.4	52.0
New Brunswick[6]	39.7	38.4	36.9	51.0	60.8	69.5	71.0	70.4	[64.0]	[g]52.8	43.0	29.2	[52.2]
Newton	[38.0]	34.4	[36.0]	48.3	58.1	68.0	69.3	68.5	60.8	49.1	38.6	[29.0]	[49.8]
Ocean City	43.4	43.0	39.7	50.2	58.8	72.5	73.4	73.2	67.8	56.7	47.2	33.0	54.9
Oceanic	42.4	40.9	39.2	53.3	63.4	[73.0]	74.0	72.9	67.4	55.5	45.6	34.1	[55.1]
Princeton	39.1	38.2	36.2	50.0	60.9	------	------	------	------	50.0	44.0	------	------
Readington	42.5	41.9	[f]38.6	52.9	63.4	72.2	75.4	74.0	[f]67.2	[i]54.1	45.3	33.6	55.1
South Orange	37.4	37.0	34.8	49.0	58.0	69.1	70.1	69.5	62.6	51.4	41.3	27.9	50.7
Tenafly	37.2	36.0	34.4	48.1	58.9	68.4	71.3	70.0	62.0	50.7	40.0	27.7	50.4

1 L. Merrill.
2 Signal Service.
3 Medical department.
4 Pacific Railway System.
5 W. Little.
6 C. V. Meyers.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
New Jersey—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
Trenton	43.0	44.0	40.0	54.0	66.0	76.0	78.0	76.0	68.0	57.0	46.0	32.0	56.7
Union	37.4	37.1	35.1	49.4	58.7	68.2							
Woodbury	42.7	42.6	40.6	53.0	63.6	[g]74.0	74.6	73.6	67.4	55.7	46.3	33.0	55.2
New Mexico:													
Albert						80.4	80.6	76.5	69.0	58.8	49.1	44.8	
Albuquerque	34.5	42.8	48.4		[n]68.8	[g]71.7	[i]77.8	75.0	67.9				
Chama	16.6	30.4	36.6	44.4	54.2	59.8	68.4	66.8	59.2	48.4	40.3	30.9	46.3
Coolidge	[32.0]	36.7	34.0	35.9	58.2	64.0	71.3	64.7	[63.0]	48.2	48.2	30.6	[48.9]
Deming	42.8	50.4	58.4	64.4	75.2	78.9	80.7	82.2	74.4	62.7	52.7	[42.0]	[63.8]
Fort Bayard	[42.0]	44.2	47.6	52.8	62.7	68.0	72.6	67.7	64.8	55.4	45.4	43.2	[55.5]
Fort Marcy	30.5	34.6	40.7	47.8	58.5	64.5	70.2	67.4	61.0	48.9	38.0	31.8	49.5
Fort Selden	44.2	49.2	55.4	63.3	72.6	77.4	83.0	79.6	73.4	[58.0]	[45.0]	[43.0]	[62.0]
Fort Stanton[1]	38.4	42.2	46.6	51.1	61.0	65.8	70.2	66.3	60.3	52.2	39.7	39.0	52.7
Fort Stanton[2]	39.5	42.8	40.3	51.2	60.9	66.4	70.5	67.0	61.0	50.9	39.0	38.0	52.3
Fort Union	33.5	28.1	32.1	42.2	54.4	58.4	66.9	67.2	59.5	48.0	36.8	32.6	46.6
Fort Wingate	32.0	37.2	42.4	49.5	59.8	65.6	73.3	70.0	63.1	49.2	40.4	37.1	51.6
Gallinas Spring	41.8	44.8	50.0	57.4	66.7	73.6	77.0	75.6	67.3	58.4	47.3	44.5	58.7
Hillsboro	41.9	46.6	51.4	57.4	66.9	71.2	76.5	72.9	66.2	57.5	45.1	43.2	58.1
La Luz		47.2	56.8	64.2						59 2	48.8		
Lava	41.3	46.4	52.8	60.6	71.6	79.0	83.0	77.2	71.3	59.8	[44.0]	[43.0]	[60.8]
Lordsburg	43.7	45.5	55.8	64.4	79.5	83.1	85.2	78.6	74.4	62.1	48.1	46.3	63.9
Los Lumas	37.1	43.3	49.0	57.5	68.7	74.6	79.4	75.6	[68.0]	51.4	[40.0]	38.2	[56.9]
Red Cañon	[38.0]	42.1	47.8	54.8	[71.0]	73.0	77.6	72.8	66.2	53.7	43.3	40.0	[56.7]
Roswell	34.9	37.3	42.4	53.2	62.8	68.2	73.4	70.8	66.7	[52.0]	[40.0]	[39.0]	[53.4]
Santa Fé	32.2	36.6	42.0	47.8	59.2	64.7	69.8	67.2	61.0	50.0	39.6	34.6	50.4
New York:													
Addison									60.8	48.5	39.5	24.6	
Adelphi Academy	41.2		39.2	[f]49.6		69.2			65.8	54.2	44.4	32.0	
Alabama					53.1	67.7	68.5	64.5	58.8	49.3	38.7	22.3	
Albany	30.6	31.0	31.0	47.3	57.1	68.5	71.4	70.6	62.0	50.6	38.4	19.8	48.2
Alfred Center	31.8	30.9	26.2	43.7	52.2	64.7	66.0	62.2	56.1	45.3	[d]35.5	21.1	44.6
Angelica	31.9	31.4	26.6	42.7	53.2	65.5	65.9	61.8	55.9	46.2	36.8	21.2	44.9

Arcade					51.5	65.3	65.6	61.9	55.8	45.3	35.9	21.2	
Ardenia	36.1	36.5	34.2	49.2	58.3	69.1	69.8	69.8	57.7	51.5	41.6	25.5	49.9
Binghamton							[1]67.7	66.4	59.4	47.5	37.8	22.8	
Boyds Corners	35.8	35.8	34.1	49.5	60.2	69.2	71.8	70.4	61.1	51.7	40.7	26.8	50.6
Brookfield	28.9	28.5	25.9	42.5	52.2	63.8	65.4	62.5	56.5	44.9	33.7	18.0	43.6
Brockport	[33.0]	[32.0]	30.7	47.0	54.6	68.5	70.2	[i]70.3	[e]61.0	47.9	37.8	[f]22.2	[47.9]
Buffalo	32.8	31.4	29.1	43.7	52.0	66.6	69.6	65.8	59.9	50.0	39.4	25.4	47.1
Canton	20.5	21.7	27.1	41.9	53.0	65.7	68.6	63.5	56.3	45.6	33.2	12.5	42.5
Carmel	34.8	35.9	32.4	49.8	58.8	68.6	71.0	70.6	61.4	50.6	38.7	24.6	49.8
Central Park (New York)	37.6	37.9	35.6	49.1	60.2	70.1	73.1	72.7	67.1	54.5	43.9	29.9	52.6
Constableville	24.8	22.6	22.5	37.2	50.5	63.5	65.9	63.3	54.4	44.1	31.7	12.9	41.1
Cooperstown	29.9	29.2	26.3	42.8	53.4	65.4	65.4	63.6	57.1	45.5	34.7	18.4	44.3
Davids Island	37.2	35.6	33.5	46.6	57.5	67.7	70.8	69.4	64.0	51.8	40.8	28.4	50.3
Eden	33.9	32.1	31.0	48.3	56.6	71.5	73.8	67.8					
Elmira	35.6	34.6	31.4	47.2	56.9	70.1	71.1	69.0	62.3	50.7	40.6	25.4	49.6
Factoryville	33.5	32.1	28.6	44.7	54.5	66.0	67.2	65.2	58.3	47.8	38.0	23.3	46.6
Fleming	30.6	29.9	27.7	43.8	52.2	65.2	68.5	64.9	59.7	47.3	38.6	21.9	45.9
Fort Columbus	39.6	39.2	38.8	48.8	56.4	70.0	72.4	71.3	66.4	55.4	44.8	30.0	52.8
Fort Hamilton	39.0	38.5	36.8	48.9	57.8	68.7	70.8	70.3	66.2	53.7	44.6	32.4	52.3
Fort Niagara	34.4	32.2	31.3	46.4	54.0	68.9	73.8	68.6	62.4	52.0	41.8	27.2	49.4
Fort Porter	33.0	32.2	30.7	44.4	53.4	67.2	71.4	66.8	59.2	49.7	40.4	[25.0]	[47.8]
Fort Schuyler	37.2	36.2	33.4	47.0	57.4	67.7	70.6	70.4	65.0	53.3	42.9	28.1	50.8
Fort Wadsworth	40.0	39.4	37.6	49.9	59.8	71.1	72.9	72.4	66.0	54.6	43.7	30.1	53.1
Geneva	33.6	32.0	30.7	45.6	53.5	67.5	69.9	65.9	60.2	49.3	38.9	24.4	47.6
Hammondsport								65.1	59.3	50.4	40.8	28.8	
Hess Road Station	31.8	29.3	27.5	43.8	57.6	67.0	69.0	65.0	57.9	45.6	38.6	24.7	46.5
Honeymead Brook	32.4	32.5	27.4	45.8	56.4	65.7	67.8	66.6	59.0	47.7	36.9	22.8	46.8
Humphrey	34.2	33.2	28.7	45.2	54.1	67.1	67.8	63.8	59.3	47.7	38.8	23.9	47.0
Hyndsville							67.1	65.7	58.5	45.4			
Ilion	30.2	29.5	28.7	44.9	55.2	66.2	67.7	66.1	58.7	48.1	37.0	[19.0]	[45.9]
Italy Hill								62.2	55.3		34.7	20.6	
Ithaca	33.1	32.1	30.7	46.2	54.3	68.4	70.0	66.7	60.1	49.4	39.4	26.0	48.0
Keene Valley	22.9	23.3	25.3	35.8	48.8	58.5	60.6	59.9	55.4	45.5	29.6	7.5	39.4
Le Roy	[33.0]	27.8	25.8	[45.0]	[53.0]	64.6	65.9	64.7	58.5	47.9	37.2	23.7	[45.6]
Lowville									54.1	44.8	31.0	12.4	
Lyons	32.6	31.0	30.4	45.0	53.8	67.7	69.7	66.3	59.6	49.2	38.9	24.4	47.4
Madison Barracks	26.4	22.0	27.4	[43.0]	52.0	65.4	71.3	66.9	59.3	48.0	35.0	15.4	[44.3]
Malone		22.3		40.4							31.6	10.8	

[1] Signal Service.

[2] U. S. post hospital.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	°	°	°	°	°	°	°	°	°	°	°	°	°
New York—Continued.													
Marshland	33.6	34.3	29.8	44.0	53.5	63.8	63.2	63.4	58.2	47.1	38.7	23.4	46.1
Middleburg	32.3	31.4	30.4	47.1	57.5	66.1	68.6	67.1	59.8	48.3	37.3	19.7	47.1
Middletown	[36.0]	32.6	31.2	46.7	56.2	68.5	68.2	68.3	61.9	48.2	38.2	23.8	[48.3]
Mount Morris							70.0	66.1	59.1	50.4	39.0	24.5	
New Lisbon	[32.0]	27.1	25.4	41.3	52.2	62.9	63.4	60.9	54.1	44.0	33.4	18.0	[41.9]
New York	40.2	40.4	37.5	51.0	60.6	70.4	73.4	72.3	66.8	55.5	45.9	31.4	53.8
North Hammond	22.7	22.9	27.1	43.4	53.5	66.5	68.7	64.6	[57.0]	[46.0]	34.4	14.3	[43.4]
Number Four	23.3	22.1	23.3	39.2	49.8	61.7	63.1	60.3	52.9	42.9	29.7	11.1	40.0
Ogdensburg	17.6	17.7	23.8	40.2	51.6	66.9	70.4	66.4	59.2	48.0	33.6	8.2	42.0
Oswego	29.6	28.6	28.7	42.9	50.8	64.9	68.6	66.4	59.4	49.4	37.3	20.4	45.6
Oxford	29.9	28.5	25.7	40.0	51.0	64.0	64.1	61.5	54.9	44.1	32.9	17.7	42.9
Palermo	29.4	27.5	27.8	43.2	52.2	66.4	67.6	65.2	57.9	47.9	36.9	19.5	45.1
Palmyra	34.9	33.8	32.4	47.0	55.6	70.0	72.1	67.4	61.0	50.6	39.1	24.0	49.0
Peekskill	h30.8	33.3	31.6	46.3	55.8	66.3	68.8	67.8	60.5	49.3	c41.5	24.7	48.1
Pendleton Center	30.5	28.4	27.0	44.2	51.7	66.1	68.7	64.2	57.5	47.0	36.7	23.0	45.4
Perry City	31.8	30.0	27.2	42.4	52.3	64.6	66.6	63.3	57.2	46.3	35.7	21.4	44.9
Plattsburg	19.9	22.4	27.8	41.8	52.3	64.3	67.6	64.4	57.4	46.9	33.9	14.0	42.7
Plattsburg Barracks	22.6	23.6	28.9	41.6	50.5	62.3	[68.0]	64.7	57.2	46.5	33.5	11.3	[42.6]
Port Jervis	31.7	30.3	29.5	46.4	57.2	66.4	66.9	65.1	58.3	46.7	35.8	22.4	46.4
Potsdam	19.4	20.6	25.7	41.3	51.0	63.9	67.3	64.3	55.8	45.3	31.1	11.0	41.4
Poughkeepsie	33.4	34.4	31.4	47.4	57.0	67.4	69.2	69.6	60.8	49.4	58.4	23.8	50.2
Quaker Street	25.6	25.4	25.7	43.8	52.5	63.7	66.0	64.3	56.3	44.1	32.7	14.9	42.9
Queensbury	26.8	23.8	25.7	42.2	56.6		70.2	67.9	56.3				
Rochester	32.7	31.6	29.8	45.8	53.6	68.0	70.8	66.8	60.6	50.4	39.0	23.9	47.8
Rome	28.7	27.8	27.9	43.2	53.0	66.1	69.0	66.5	56.9	47.2	33.8	17.7	44.8
Rondout (Kingston)	33.0	32.0	31.4	49.0	57.5	67.5	68.8	69.0	60.0	50.3	38.4	24.2	48.4
Setauket	38.8	37.6	35.4	47.3	57.1	66.1	70.4	69.8	64.0	52.8	43.7	31.0	51.2
Sherman	[36.0]	32.2	27.3	43.7	52.6	64.5	64.0	f60.8	50.2	48.0	37.6	23.5	[45.0]
South Canisteo	32.7	31.4	27.0	42.8	52.6	64.3	65.0	61.8	56.0	45.9	37.0	21.4	44.8
South Kortright	31.8	30.7	26.4	43.4	54.3	62.1	64.8	60.8	56.4	46.1	34.6	19.0	44.2
Turin	23.0	21.9	22.2	39.3	51.3	65.1	69.8	63.5	56.0	44.0	30.1	12.1	41.5
Utica	30.3	29.2	29.0	44.0	54.9	66.1	69.0	68.3	58.8	48.4	37.1	19.6	46.2

Watervliet Arsenal	30.9	30.8	23.9	47.3	56.5	68.0	71.0	68.2	60.2	48.5	37.2	[19.0]	[49.8]
Wedgewood	31.0	29.5	26.5	42.8	51.7	65.8	67.2	63.5	57.5	45.6	35.6	20.5	44.8
West Point	33.0	32.7	31.2	45.1	56.2	67.4	70.0	69.6	61.2	46.9	36.6	17.6	47.3
White Plains	38.9	37.9	35.5	48.8	58.5	68.6	70.3	70.5	62.9	51.6	43.2	29.7	51.4
Willets Point	39.8	38.7	35.9	47.2	59.9	69.0	71.8	70.6	64.7	54.0	44.2	30.5	52.2
North Carolina:													
Asheville[1]	47.2	49.0	42.6	56.8	62.4	71.7	70.8	67.9	65.6	53.0	51.4	39.2	56.5
Chapel Hill	46.0	*c*47.8	49.8	59.0	69.3	*d*79.1	[76.0]	[73.0]	70.0	58.9	52.3	40.8	[60.2]
Charlotte	50.8	52.8	49.6	60.6	69.8	80.2	77.3	75.3	70.8	59.7	55.4	42.9	62.1
Clear Creek	52.0	54.6	51.0	59.2	66.4	78.4	76.4	73.4	69.6	58.9	[55.0]	[42.0]	[61.4]
Douglas	45.2	48.8	46.4	56.9	67.6	78.4	77.2	74.4	70.6	[55.0]	50.6	37.6	[59.1]
Fayetteville	------	------	------	------	------	*g*82.4	79.4	76.4	73.2	------	------	------	------
Franklin	48.2	49.4	45.1	56.1	60.6	71.0	71.2	68.7	66.0	53.6	46.6	38.2	56.2
Goldsboro	------	------	------	------	72.2	81.0	79.6	77.2	73.4	63.6	55.8	------	------
Hatteras	55.7	56.4	52.6	58.0	68.8	77.2	76.7	76.0	75.8	65.0	56.8	47.0	63.8
Highlands	41.7	43.0	39.6	[62.0]	57.5	66.6	66.4	63.8	61.2	48.6	45.4	35.2	[52.6]
Hot Springs	49.4	50.9	46.1	58.1	64.1	75.0	74.5	71.2	69.2	56.4	51.2	[39.0]	[58.8]
Kitty Hawk	[52.0]	*f*53.2	*c*52.2	60.8	*b*69.8	*c*78.7	*f*77.4	78.6	76.4	*b*64.2	55.4	*c*46.4	[63.8]
Lenoir	46.5	49.0	44.4	57.8	64.9	73.8	73.0	70.0	67.9	55.0	49.8	38.9	57.6
Lumberton	------	------	------	------	71.4	80.6	78.3	76.9	73.6	62.2	54.6	------	------
Marion	------	------	------	------	------	*c*75.1	73.0	71.4	68.9	56.4	52.3	40.0	------
Morganton	[46.0]	48.6	[44.0]	57.2	64.0	75.0	74.2	71.9	68.3	56.1	52.1	41.4	[58.2]
Mount Airy	46.7	47.6	43.6	55.4	64.3	75.4	74.6	71.1	68.9	55.5	49.0	37.0	57.4
Mount Pleasant	49.8	52.2	48.2	58.8	68.2	77.5	75.6	72.8	69.4	58.0	51.1	40.4	60.2
New Berne	54.7	58.0	53.6	60.6	71.4	78.5	77.4	75.6	72.8	61.3	54.6	[45.0]	[63.6]
Oak Ridge	*h*44.8	48.8	44.1	55.4	66.4	[76.0]	[75.0]	*l*70.6	68.3	54.8	50.2	37.6	[57.7]
Pittsboro	49.7	51.0	46.9	57.0	66.8	76.9	75.4	72.2	69.0	58.0	51.3	40.2	59.5
Raleigh[2]	51.6	52.7	49.6	59.6	69.4	78.6	76.6	74.5	71.0	60.3	53.8	41.3	61.6
Raleigh[1]	53.0	54.0	50.0	61.0	71.0	80.0	79.0	74.0	72.0	61.0	[53.0]	43.0	[62.6]
Salisbury	50.3	52.5	48.8	60.9	71.1	80.9	79.6	76.8	71.6	60.4	55.8	43.2	62.7
Smithfield	------	------	------	------	------	*o*82.4	77.2	75.0	71.4	60.7	52.6	40.9	------
Soapstone Mount	39.0	48.5	45.1	*d*54.4	65.1	74.2	76.2	71.6	68.5	*d*55.6	43.8	35.6	56.5
Southport	56.0	56.2	53.6	60.4	71.4	79.4	78.6	77.2	75.0	64.4	56.6	46.4	64.6
Wadesboro	------	------	------	------	70.0	*f*78.6	77.2	73.6	69.9	58.6	52.8	------	------
Washington	51.0	56.8	51.2	59.6	72.0	77.6	78.4	72.2	74.3	63.9	55.6	44.5	63.1
Weldon	50.4	51.6	47.7	58.1	68.5	77.0	80.0	74.2	70.8	59.2	50.2	39.1	60.6
Willeyton	[51.0]	53.3	49.4	58.8	67.6	76.0	78.4	73.7	71.3	59.4	52.2	40.8	[61.0]

[1]Signal Service. [2]T. C. Harris.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	°	°	°	°	°	°	°	°	°	°	°	°	°
North Carolina—Continued.													
Wilmington	57.2	58.4	53.2	61.0	70.8	80.1	77.4	76.4	74.0	63.9	57.4	47.4	64.8
Winslow	52.6	53.9	51.6	60.2	68.7								
North Dakota:													
Bismarck	—2.1	3.6	20.6	46.8	51.3	66.9	71.0	66.8	56.4	46.2	37.0	24.9	40.8
Davenport	1.4	6.0	20.4	47.0	50.8	70.0	72.5	64.0	55.1	45.2	[33.0]	[19.0]	[40.4]
Fort A. Lincoln	—3.1	3.4	19.2	45.4	49.0	67.2	72.1	68.2	58.1	47.1	37.8	25.8	41.4
Fort Buford[1]	—4.2	0.9	22.4	43.6	50.8	65.1	71.4	66.2	55.4	44.4	35.8	26.0	39.8
Fort Buford[2]	—3.8	—0.2	22.6	45.0	51.9	65.7	72.3	67.0	56.4	45.0	35.8	26.4	41.0
Fort Pembina	—7.4	—6.4	11.1	41.8	45.4	67.8	69.1	63.1	54.1	43.7	32.4	16.8	38.3
Fort Totten	—7.2	—1.6	14.4	42.3	46.8	67.2	70.6	64.3	54.9	44.6	35.6	[17.0]	[37.4]
Fort Yates[1]	3.6	9.9	25.8	50.1	54.9	69.4	74.0	69.0	59.0	47.6	37.8	25.8	43.9
Fort Yates[2]	3.5	9.6	24.6	49.0	53.9	69.2	74.0	69.0	59.1	47.8	37.5	25.2	43.5
Gallatin	—5.8	—3.3	12.7	42.1	45.6	65.3	66.4	65.2	54.7	40.4	28.6	16.0	35.4
Grand Forks				43.0	47.4	68.1	70.9			42.9	30.3	18.7	
Kelso							68.8	62.3	54.2	44.2	32.9	19.1	
Napoleon	—1.0	3.4	19.7	44.6	[50.0]	66.0	70.6	64.5	55.7	43.7	32.5	21.9	[39.3]
New England City	—2.6	5.3	24.2	44.7	49.3	62.6	68.8	65.3	55.0	41.2	35.8	21.3	39.2
Steele	—2.4	1.5	18.6	46.6	49.8	67.1	72.0	66.8	57.4	45.8	34.8	22.0	40.0
Wahpeton	2.7	8.1	21.8	52.3	53.8	72.5	74.3	68.1	59.5	47.4	34.8	21.5	43.1
Wild Rice						67.5	70.7	61.9	51.3	42.4	27.8	15.1	
Ohio:													
Akron	36.7	36.9	31.3	48.5	56.4	71.2	71.4	66.8	60.6	51.4	42.3	29.4	50.2
Ashland	36.4	35.7	32.7	51.8	57.4	73.1	73.0	68.7	63.0	52.0	43.0	29.6	51.4
Athens	41.8	42.6	36.6	53.2	60.2	72.8	g72.0	68.5	63.4	53.0	45.1	32.8	57.7
Bangorville	36.2	36.6	31.1	48.8	56.4	70.1	70.1	66.3	59.8	50.3	41.6	28.5	49.6
Bellevue	36.0	35.4	31.4	46.8	55.8	69.9	71.0	66.8	[62.0]	51.6	41.4	27.2	[49.6]
Bement	36.4	35.7	31.1	46.1	56.8	71.5	71.4	65.8	59.6	49.4	40.2	26.9	49.2
Bucyrus			32.2	48.8	59.1	73.8							
Canton	36.8	37.2	32.2	49.2	57.4	71.6	71.7	67.5	61.4	51.8	42.0	29.3	50.7
Carrollton	37.0	37.4	31.6	49.2	58.1	71.2	70.4	66.3					
Celina	38.6	39.8	35.1	52.4	60.4	74.8	74.9	70.1	61.8	53.9	45.6	33.8	53.4
Cincinnati	41.5	43.1	39.7	55.8	63.8	77.8	77.0	72.6	65.8	56.8	47.8	35.8	56.4

Clarksville	39.9	40.3	34.9	53.2	60.0	73.6	74.4	69.6	62.5	52.8	44.3	31.4	53.1
Cleveland[1]	37.0	36.3	32.0	46.6	55.8	70.4	71.4	67.6	62.0	53.2	43.4	30.0	50.5
Cleveland[3]	38.4	37.2	33.2	48.2	56.4	70.2	71.0	67.0	60.5	52.6	43.9	30.7	50.8
College Hill	41.6	42.0	39.6	56.7	64.3	78.3	78.6						
Columbus	39.1	40.6	35.2	52.3	60.0	74.6	73.6	70.2	63.1	53.9	45.5	31.8	53.2
Columbus Barracks	39.3	41.3	35.9	52.8	59.8	73.8	73.6	70.0	63.1	53.8	44.6	31.1	53.3
Dayton	40.5	41.0	36.9	53.8	62.3	77.6	77.9	72.3	63.4	54.4	45.3	32.7	54.8
Demos	40.0	40.2	32.6	50.2	58.5	72.7	71.0	68.4	61.6	51.2	42.2	29.0	51.5
Elyria	36.4	37.2	32.3	46.9	57.4	72.8	72.1	67.6	62.4	51.9	43.6	29.7	50.9
Findlay	36.5	36.7	32.7	49.3	57.7	72.5	e71.5	67.5	59.5	51.0	42.4	29.8	50.6
Fostoria	36.8	37.1	33.8	51.0	59.1	75.5	75.1	69.9	[61.0]	51.7	[44.0]	[30.0]	[52.1]
Garrettsville	35.1	34.4	29.3	45.5	54.1	67.6	67.3	63.3	57.7	47.8	39.9	26.6	47.4
Georgetown	41.6	42.3	36.6	54.7	62.0	75.9	75.8	70.6	65.1	54.4	40.5	34.4	54.5
Granville	37.3	39.2			59.0			67.7	61.6				
Gratiot	39.0	41.3	35.5	51.8	58.7	72.8	72.6	68.6	62.8	53.1	43.8	31.1	52.6
Greenville	37.1	38.2	34.1	51.5	58.8	73.5	73.6	68.6	60.4	52.1	43.2	30.5	51.8
Hanging Rock	43.1	44.0	37.7	53.5	60.7	72.8	71.3	68.5	63.9	55.0	46.9	33.8	54.3
Hassan	32.4	38.8	32.6	44.0	53.0	74.3	66.9	60.7	[61.0]	52.8	45.1	[30.0]	[49.3]
Hiram	34.6	34.4	28.8	46.8	55.3	68.8	69.2	65.3	59.4	49.5	40.2	26.7	48.2
Jacksonboro	38.5	39.7	34.4	52.6	61.3	75.6	75.9	72.8	64.9	55.9	46.2	31.4	54.1
Jefferson	34.9	34.3	29.0	46.0	53.5	67.5	68.0	64.6	[61.0]	49.3	40.4	28.2	[48.1]
Kent	41.0	39.2	34.8	46.1	57.2								
Kenton	38.1	38.2	33.8	51.9	59.1	73.6	71.4	68.8	60.2	52.3	43.8	28.4	51.6
Leipsic	[37.0]	36.3	34.3	50.6	57.8	77.5	75.4	70.7	61.3	48.5	39.7	[30.0]	[51.6]
Logan	41.0	41.7	36.3	53.0	60.4	73.8	72.4	68.7	62.7	53.0	45.0	32.2	53.4
Lordstown	36.4	36.0	26.8	47.3	55.5	67.5	69.8	65.5	59.1	49.3	40.6	28.0	48.6
McConnellsville	41.4	43.1	35.8	52.6	[60.0]	74.9	73.4	69.0	64.1	53.4	44.9	31.5	[53.7]
Marietta[4]	42.6	43.3	37.1	54.0	61.4	73.6	73.2	69.8	64.4	54.8	46.6	34.6	54.6
Napoleon	38.3	37.2	34.5	50.4	58.9	75.7	66.0	70.4	60.6	52.5	43.5	h31.7	52.5
New Alexandria	39.4	40.5	33.4	51.8	59.5	71.8	72.7	68.4	62.1	51.6	43.3	30.0	52.0
New Comerstown	38.4	39.1	33.4	49.2	57.6	70.1	70.1	66.3	60.6	51.2	42.5	29.8	50.7
North Lewisburg	38.0	39.4	35.0	53.9	61.8	77.5	77.4	72.3	63.9	53.2	43.7	30.6	53.9
Oberlin	36.6	36.7	32.1	48.2	56.6	70.8	70.4	65.7	60.6	50.3	42.7	29.3	50.0
O. S. University	38.8	39.9	34.3	52.6	59.3	73.4	72.9	68.5	61.4	52.3	43.5	30.7	52.3
Orangeville	33.4	j31.6	29.6	47.6	57.8	69.8	69.6	65.4	59.7	50.2	41.0	55.4	48.4
Pomeroy	44.1	46.3	40.6	57.8	65.2	79.4	[77.0]	71.4	65.9	54.7	45.7	33.8	[56.8]
Portsmouth[4]	44.8	45.2	39.9	55.4	62.2	75.5	75.1	70.6	65.3	54.6	47.5	35.9	56.0
Sandusky	35.9	35.7	31.9	47.4	56.7	72.8	73.1	68.6	62.5	53.6	44.1	30.6	51.1

[1] Signal Service. [2] U. S. post hospital. [3] G. A. Hyde. [4] Medical department.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Ohio—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
Shiloh	38.0	38.7	33.7	48.2	56.1	70.4	68.5	64.4	59.3	50.8	43.0	30.6	50.1
Tiffin	37.6	35.6	31.2	47.5	56.7	72.5	73.8	67.2	60.3	51.4	43.0	30.4	50.6
Toledo	36.1	35.8	32.5	48.2	56.2	72.8	72.6	67.8	61.0	52.6	43.2	29.7	50.7
Upper Sandusky	38.2	38.6	34.1	50.6	58.6	72.9	72.4	68.2	60.9	52.6	43.8	30.6	51.8
Vienna	34.5	34.4	28.8	46.6	56.2	71.4	72.0	67.7	60.2	49.6	40.1	26.8	49.0
Wapakoneta	37.6	37.9	33.8	49.9	60.5	75.2	75.0	71.2	60.7	55.0	[46.0]	[34.0]	[53.6]
Wauseon	33.4	33.3	30.8	48.6	56.1	72.8	72.8	67.7	59.1	50.1	40.8	27.6	49.4
Waverly	44.0	44.7	39.3	56.1	63.2	76.7	76.0	71.5	66.6	56.0	48.1	33.7	56.3
Waynesville	----	----	38.2	60.4	----	85.2	75.4	71.8	----	----	45.5	32.0	----
Westerville	37.3	38.9	33.9	51.1	58.8	71.9	71.0	[70.0]	60.3	52.2	43.7	31.3	[51.7]
West Milton	40.3	41.0	37.8	55.3	63.2	77.7	79.0	75.3	65.6	56.2	48.2	33.1	56.1
Weymouth	[37.0]	34.3	29.8	46.8	55.8	67.8	70.6	66.7	60.2	50.6	42.2	28.2	[49.2]
Wooster	36.0	36.6	30.9	48.4	56.0	69.8	70.5	65.8	59.6	50.0	41.3	28.8	49.5
Yellow Springs	38.9	39.4	----	52.0	59.6	73.9	----	----	59.7	53.3	44.2	----	----
Youngstown	38.6	38.3	33.1	50.4	58.7	71.9	71.4	67.6	61.2	52.4	43.5	29.8	51.4
Oregon:													
Albany	34.3	38.7	45.6	49.8	61.4	63.3	65.6	67.8	61.1	51.0	44.3	42.5	52.1
Ashland[1]	29.3	36.6	43.1	50.7	59.7	62.2	68.0	68.7	62.1	47.6	41.9	37.5	50.6
Ashland[2]	30.2	36.6	41.7	49.3	58.2	60.6	67.8	69.2	63.8	51.6	46.2	39.6	51.2
Astoria	35.4	39.8	44.4	48.3	57.1	57.9	60.3	61.4	58.0	52.0	49.1	46.2	50.8
Baker City	16.1	27.7	37.6	47.2	54.6	56.2	66.4	64.5	58.6	45.5	37.7	32.3	45.4
Bandon	41.3	42.2	46.2	48.5	55.0	57.8	59.4	56.2	55.5	53.5	51.2	49.7	51.4
Beulah	14.2	27.3	37.5	47.6	56.2	56.6	65.0	62.8	55.8	44.1	34.2	28.4	44.1
Burns	----	----	35.6	m47.5	54.5	56.8	----	----	----	----	----	25.8	----
Corvallis	33.9	37.7	46.0	50.6	57.7	60.2	62.4	64.9	[61.0]	50.4	43.6	42.4	[51.0]
Creswell	36.6	38.6	47.4	52.0	----	----	----	----	----	----	----	----	----
East Portland	30.2	36.6	51.4	60.7	----	----	----	----	----	----	----	----	----
Eola	31.0	37.0	43.4	49.0	57.4	58.0	62.0	64.3	60.6	50.0	45.2	41.2	49.9
Forest Grove	29.0	37.3	43.4	50.8	59.7	60.2	[60.0]	[63.0]	60.4	49.7	44.8	40.6	[49.9]
Gardiner	38.9	41.9	46.8	49.3	56.8	58.8	60.0	60.6	58.1	54.2	49.4	47.2	51.8
Gold Beach (Ellensburg)	35.9	43.7	47.4	48.5	55.4	55.9	57.8	59.0	56.6	55.1	53.3	49.0	51.5
Grant Pass	32.2	39.2	44.8	52.8	61.4	62.2	65.8	70.9	60.7	52.3	42.8	39.1	52.0

Grass Valley	18.4	26.8	37.5	44.7									
Happy Valley (Diamond)				46.4	55.6	56.5	66.1	63.3	56.6	42.4			
Heppuer	23.3	30.0	41.2	51.4	58.0	61.3	68.0	68.7	60.9	49.5	42.5	42.0	49.7
Hood River	22.8	32.2	43.2	53.2	63.4	63.7	69.6	70.4	64.4	51.8	43.9	40.6	51.6
Hubbard	32.0	37.5	43.2	[52.0]	[60.0]	o60.7	62.4	63.3	59.0	49.6	43.5	41.3	[50.4]
Jacksonville	30.0	35.2	43.3	51.6	60.0	61.2	67.8	68.4	62.2	49.7	44.3	39.4	51.1
Jordan Valley	15.9	29.0	m36.1	46.1	54.2	56.5							
Joseph	16.0	22.9	31.2	44.0	52.9	53.4	63.5	[64.0]	56.8	42.2	37.0	29.8	[42.8]
La Grande	22.0	30.1	40.2	50.0	56.6	59.1	68.8	68.6	60.8	47.3	42.9	39.8	48.8
Lakeview						e57.2	68.0	69.4	d66.0	49.6	44.2	35.5	
Lone Rock	21.8	27.2	38.7	46.8	55.2	55.4	61.8	63.3	58.0	45.4	42.8	39.4	46.3
McMinnville	30.8	36.6	43.4	49.0	57.8	58.8	61.7	64.4	d60.8	50.5	44.8	41.6	50.0
Mount Angel	32.8	38.2	43.5	53.6	61.3	61.7	65.6	67.8	60.5	51.2	44.2	42.0	51.9
North Powder	15.8	26.2	37.0	46.1	53.6	54.4	63.8	60.8	[57.0]	43.6	31.4	[32.0]	[43.5]
Pendleton	21.0	30.1	42.0	52.2	60.1	63.0	68.8	68.8	60.0	49.6	40.4	40.5	49.7
Portland	31.8	38.5	45.2	52.4	60.6	61.8	65.5	65.9	62.4	52.6	47.2	43.0	52.2
Roseburg	36.3	40.4	46.2	52.0	59.6	61.6	65.8	67.5	60.6	54.3	46.3	44.4	52.9
St. Helens	29.6	37.8	43.7	50.8									
Silver Lake	19.7	24.0	36.2	46.6								32.6	
Siskiyou	27.6	32.4	40.3	49.4	58.2	58.7	67.0	66.8	62.6	47.0	47.7	39.9	49.8
The Dalles	21.6	30.9	42.2	52.9	63.5	62.8	69.0	69.5	62.2	50.7	41.6	37.2	50.3
Tillamook	35.7	36.6	43.8				56.6	57.6	56.8	51.5			
Toledo	39.2	41.4	47.0	50.2	57.2	57.7		61.4	57.4	51.2	50.8	47.4	
Vernonia	31.1	33.7	40.3	47.2	55.8	57.5	60.1	61.5	56.7	48.2	44.0	42.1	48.2
Weston		28.5	40.4	52.2	59.0			69.4					
Pennsylvania:													
Alleghany Arsenal	39.7	42.0	36.1	52.4	61.8	73.3	74.0	71.4	64.7	53.6	[45.0]	[32.0]	[53.8]
Altoona	42.6	41.7	37.9	52.7	59.6	73.1	74.2	72.0	64.0	54.0	47.2	34.5	54.5
Annville	39.4	39.5	37.7	53.7	63.9	75.9	76.7						
Aqueduct	38.7	38.4	36.9	50.8	61.3	73.5	74.4	70.8	64.6	53.4	43.3	29.9	53.0
Bethlehem	39.7	40.0	36.0	52.5	[60.1]	73.1	[71.0]	72.1	65.0	52.9	43.4	[28.0]	[52.8]
Blooming Grove	35.1	34.5	31.6	46.8	59.1	70.4	69.6	67.8	60.7	49.2	39.2	24.1	49.0
Blue Knob	34.1	33.2	27.3	46.4	56.8	70.1	70.0	66.0	59.3	45.9	37.8	23.4	47.5
Cannonsburg	39.6	39.0	33.0	51.2		70.7	70.7	67.3			42.7		
Carlisle	38.0	37.7	36.0	51.1	60.1	72.2	72.9	69.5	65.4	52.3	42.5	28.6	52.2
Catawissa	38.0	38.0	[36.0]	49.0	58.7	71.0	71.5	69.8	62.0	51.0	43.0	28.5	[51.4]
Center Valley	39.4	40.2	38.4	51.6									

[1] Pacific Railway station. [2] F. L. Carter.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Pennsylvania—Continued.													
Chambersburg	39.3	37.9	------	50.3	59.8	------	------	------	------	53.2	42.4	27.7	------
Charlesville	41.5	36.6	34.0	44.6	57.4	70.0	70.9	67.4	60.6	50.0	42.5	27.4	50.2
Clarion	36.5	34.8	28.2	48.4	56.2	------	------	------	------	48.8	c41.7	------	------
Coatesville	38.6	38.2	36.4	49.5	60.5	71.5	71.7	70.4	62.5	51.9	41.4	28.3	51.7
Coopersburg	37.8	37.2	34.9	50.0	59.8	70.0	70.4	68.8	62.9	53.3	41.7	28.2	51.2
Corry	34.8	34.1	28.8	45.2	54.4	67.5	67.8	64.6	57.4	46.4	38.7	b25.1	47.1
Drifton	34.2	33.4	28.9	44.6	54.7	65.3	65.8	64.8	58.7	47.6	[39.0]	[26.0]	[46.9]
Dyberry	31.6	30.1	27.5	43.4	54.0	64.0	64.8	63.0	56.4	45.8	35.6	20.6	44.7
Eagles Mere	31.0	30.4	26.3	43.6	52.5	65.4	66.5	64.0	59.6	44.8	34.8	22.1	45.1
Edinboro	33.1	32.1	27.4	43.8	54.3	67.9	69.2	61.7	58.8	47.8	38.8	24.8	46.6
Emporium	36.4	36.1	33.3	51.3	59.5	71.7	74.4	68.9	62.0	51.2	41.5	27.4	51.1
Erie	37.6	35.2	30.8	45.4	53.2	68.2	70.6	66.6	60.8	51.4	42.0	28.8	49.2
Forks of Neshaming	38.9	38.2	36.5	50.3	60.7	70.8	72.0	70.9	64.5	52.4	b42.1	30.4	52.3
Frankford Arsenal	41.8	41.9	39.6	51.9	61.7	72.5	73.6	73.1	66.8	55.0	40.7	31.6	54.2
Franklin	34.4	34.5	29.1	45.6	55.2	67.6	67.5	63.7	57.7	[49.0]	[42.0]	[27.0]	[47.8]
Germantown	39.8	39.4	[38.0]	[50.0]	61.2	71.6	73.2	72.6	65.1	53.2	43.6	30.3	[53.2]
Gettysburg	39.1	37.8	------	48.7	59.6	70.3	73.3	70.3	------	------	------	------	------
Girardville	36.4	35.8	33.4	48.5	58.7	70.0	69.6	67.0	61.4	50.2	40.7	27.5	49.9
Grampian Hills	34.7	33.8	28.4	46.8	57.2	70.0	70.2	66.1	59.6	48.2	39.2	24.0	48.2
Greenville	35.0	35.8	30.1	44.6	[56.0]	67.8	69.1	66.0	60.9	50.2	41.4	26.6	[48.6]
Harrisburg	38.0	37.6	35.6	50.8	60.8	72.4	72.7	71.2	64.2	53.2	43.4	29.4	52.4
Hollidaysburg	38.7	37.3	33.4	49.5	60.0	71.0	71.3	68.0	62.0	50.7	42.7	28.4	51.1
Honesdale	33.0	33.2	30.4	45.4	56.4	66.2	66.5	65.9	59.8	48.2	37.2	22.1	47.0
Huntingdon	38.4	37.7	34.9	46.2	58.5	73.7	69.0	68.6	62.4	50.6	d43.2	28.9	51.0
Indiana	------	38.5	33.4	53.1	------	------	70.3	------	61.2	49.9	40.4	27.4	------
Johnstown	41.3	40.4	34.3	49.7	59.5	69.9	71.3	68.8	63.5	52.4	[45.0]	29.9	[52.2]
Kennett Square	36.7	37.6	34.8	42.5	61.0	70.5	70.7	69.0	63.4	50.9	39.4	29.1	50.5
Kilmer (Tuscarora)	39.1	38.8	39.3	52.9	62.9	75.1	75.4	72.9	65.4	54.9	44.4	31.0	54.3
Lancaster	35.7	38.8	36.3	50.9	60.3	70.4	[72.0]	[71.0]	59.1	52.9	43.1	m31.4	[51.8]
Le Roy	33.0	32.2	39.3	45.6	55.6	68.1	69.9	67.2	61.2	48.7	38.0	22.5	48.4
Lewisburg	37.0	36.9	34.5	50.8	59.9	71.9	72.6	70.8	63.2	52.3	42.0	27.8	51.6

Lewistown	38.2	37.9		52.1	61.2	70.1	74.8	72.2					
Ligonier	[39.0]	[38.0]	[40.0]	51.0	60.4	72.1	73.4	68.7	64.0	52.3	43.7	29.9	[52.7]
Lock Haven	36.3	35.6	32.9	48.6	59.2	70.7	71.1	70.9	62.1	50.7	[44.0]	26.6	[50.7]
Lynnport	35.9	36.2	34.8	48.7	59.0	70.8	70.3	70.2	63.1	[51.0]	[43.0]	[28.0]	[50.9]
McConnellsburg	40.5	39.2	37.0	51.0	60.4	70.2	71.0	68.9	63.1	52.5	42.9	29.4	52.2
Mauch Chunk	35.7	36.0	34.0	47.7	58.4	68.8	69.0	68.4	62.4	52.5	39.0	27.1	49.9
Meadville	[35.0]	[35.0]	28.2	44.7	53.5	67.5	67.8	63.9	57.9	48.7	40.2	26.5	[47.4]
Meshoppen	32.6	32.8	28.6	44.6									
Myerstown	36.4	36.8	35.3	48.4	59.8	70.5	71.7	69.0	62.3	52.3	40.5	28.2	50.9
New Bloomfield	37.4	36.7	34.3	48.6									
New Castle	39.3	40.9	34.1	53.1	62.6	73.4	73.4	69.6	62.9	52.7	43.7	29.8	53.0
Nisbet	35.6	35.8	32.8	47.5	57.4	69.8	69.7	67.7	60.6	50.6	42.6	26.2	49.7
Petersburg	38.2	35.5	31.0	47.8	57.6	69.9	70.7	69.4	63.1	52.6	43.1	29.4	50.7
Philadelphia	41.8	41.4	38.8	52.0	62.8	73.6	74.6	73.6	67.2	55.5	46.4	32.2	55.0
Philipsburg	36.0	35.6	30.4	46.4	56.9	*f*68.0	67.2	76.4	59.6	49.0	*f*39.8	24.6	49.1
Pittsburg	41.4	42.0	35.8	52.6	62.0	73.5	74.0	71.1	64.6	54.2	45.4	33.1	54.1
Phœnixville									65.3	54.1	44.8	30.7	
Pleasant Mount	30.1	29.3	25.8	46.3	52.7	64.6	66.9		57.9	45.9	34.3		
Pottstown	39.9	39.8	38.0	51.7	62.8	72.2	72.4	70.9	66.0	54.0	44.0	29.7	53.4
Quakertown	37.3	36.8	33.8	48.4	59.0	69.2	69.7	68.5	61.2	50.6	44.1	27.0	50.1
Reading	38.6	36.4	35.5	50.3									
Rimersburg	35.0	34.2	28.7	48.2	56.7	[68.0]	75.1	68.5	61.0	49.4	40.2	25.9	[49.2]
Salem Corners	32.6	31.9	28.0	45.1	54.8	65.4	69.0	68.1	67.8	52.6	40.7	25.8	48.5
Selins Grove	37.0	[38.0]	[33.0]	51.8	60.8	73.5	73.5	70.0	62.2	51.7	40.5	28.2	[51.7]
Somerset	38.0	36.8	38.0	47.0	55.7	68.1	67.7	65.4	59.6	49.0	41.1	26.8	49.4
South Eaton	35.2	34.8	31.3	44.6	56.3	67.5	68.4	67.4	57.5	49.8	40.2	25.6	48.2
State College	36.6	35.3	30.7	48.4	57.2	68.8	69.5	66.8	60.6	49.4	41.4	25.9	49.2
Swarthmore	40.7	40.2	37.6	50.5	60.9	[72.0]	72.4	*d*72.2	64.3	53.3	43.4	30.7	[53.2]
Tipton	37.0	[40.0]	32.0	48.3	58.0	71.3	72.4	69.2	61.8	51.4	42.4	[27.9]	[50.9]
Troy	35.4	[34.0]	30.2	45.6	55.0	67.1	68.7	66.0	*g*57.5	49.2	39.1	25.2	[47.8]
Uniontown	43.2	32.1	37.3	52.1	62.4	73.7	72.9	71.6	66.7	56.4	47.8	33.1	54.9
Waynesboro	41.8	40.5	34.4	50.8	63.4	70.7	71.4	67.1	56.4	45.0	[45.0]	32.0	[51.5]
Wellsboro	35.8	34.0	27.8	44.7	53.5	64.5	65.5	62.2	56.6	46.5	36.2	22.2	45.8
West Chester	39.6	39.3	37.0	50.1	60.7	71.5	71.8	71.1	65.2	53.4	44.2	29.9	52.8
Westtown	*n*40.8	40.1	37.6	[50.0]	62.2	72.2	[73.0]	[72.0]	64.8	53.6	43.4	31.7	[53.4]
Wilkes Barre	37.5	37.0	34.6	49.8	59.0	71.0	70.1	69.0	62.2	48.2	[43.0]	23.5	[50.4]
Wysox	35.3	34.2	30.3	*d*44.9	[55.0]	67.2	68.3	66.3	59.4	48.1	39.0	23.7	[47.6]
York	39.9	39.1	35.8	50.1	59.8	71.2	72.7	71.5	67.3	52.9	44.2	29.8	52.8

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Rhode Island:	°	°	°	°	°	°	°	°	°	°	°	°	°
Block Island	37.0	37.2	35.4	44.6	52.2	61.6	67.6	67.9	63.7	53.4	44.0	31.4	49.7
Bristol	36.2	35.7	35.0	45.1	55.0	63.7	68.3	68.4	63.6	50.9	41.7	28.2	49.3
Fort Adams	35.5	35.1	34.9	46.3	52.2	62.6	67.4	67.8	64.1	52.6	40.2	26.8	48.8
Kingston[1]	36.2	35.3	35.3	45.0	54.1	63.1	68.3	67.3	61.8	49.8	41.3	27.4	48.7
Kingston[2]	34.0	34.0	33.8	45.2	54.4	63.6	68.8	67.5	62.8	49.7	40.4	26.8	48.4
Narragansett Pier	36.0	35.5	34.0	45.2	55.1	64.2	69.6	68.8	64.2	51.6	42.2	29.0	49.6
Newport	37.4	37.2	36.6	47.7		65.6			65.0	52.2	44.2		
Olneyville	36.6	36.5	36.6	47.4	57.8	66.1	72.0	70.8	64.9	52.2	43.8	30.0	51.2
Providence[3]	35.8	35.1	34.8	47.5	[57.0]	65.9	71.9	69.7	63.7	50.8	42.2	28.0	[50.1]
Providence[4]	33.5	33.8	33.6	46.6	57.1	65.5	71.4	69.9	63.1	49.4	40.9	26.3	49.3
South Carolina:													
Aiken	55.3	58.3	53.8								59.5	48.4	
Allendale					72.1	82.3	80.2	78.4	74.8	64.8	59.2		
Batesburg					72.6	81.8	80.1	78.0	74.9	63.6	59.8		
Belmont	52.0	55.0	49.8	62.8	69.8	79.6	77.8	75.5	70.9	59.8	56.4	44.6	62.8
Blackville					73.3	83.4	81.3	79.4	74.6	63.8	58.6		
Branchville					71.2	81.2	77.0	76.5	73.2	61.5	56.7		
Brewer Mine	52.5	57.0					79.1	74.6	70.7	61.1	56.0	44.5	
Charleston	59.3	60.6	56.4	64.8	73.0	82.2	79.8	79.8	76.2	67.6	62.2	51.4	67.8
Cheraw	55.2	57.0	54.6	63.2	72.3	82.5	81.7	77.0	73.4	62.7	54.6	43.7	64.8
Chester					69.0	f87.5	78.2	78.9	77.0	66.4	61.8		
Columbia	54.8	57.6	54.2	63.8	71.6	81.4	78.3	77.0	73.0	62.2	57.8	46.0	64.8
Conway	56.7		55.9	60.2	70.0	80.8	77.2				57.1		
Evergreen		52.4	45.1		66.2	78.0	77.2	75.7	68.4				
Florence					72.8	81.9	80.2	78.2	74.2	64.2	57.9		
Greenville					68.0	77.9	77.4	74.3	71.2	61.2	55.6		
Greenwood	50.4	56.8	48.6	[64.0]	70.2	80.6	78.6	77.4	72.5	61.1	57.6	[46.0]	[63.6]
Hardeville	59.0	61.4	57.2	66.9	72.7	80.8	79.0	79.0	75.4	67.6	62.4	[51.0]	[67.7]
Jacksonboro					71.0	81.6	79.2	77.2	74.0	64.4	60.4	48.2	
Kingstree					71.2	81.0	79.8	78.4	75.0	65.4	58.0		
Kirkwood	50.2	51.8	49.3	58.5	67.6	77.2	75.4	72.1	69.3	57.2	49.4	40.4	59.9
Port Royal	58.8	59.9	56.6	65.6	73.5	83.4	80.0	79.9	75.2	67.5	61.6	51.6	67.8

St. Georges					70.8	81.1	78.8	77:4	73.9	64.2	58.4		
St. Matthews					72.6	80.8	78.7	77.4	73.8	66.0	56.4		
Simpsonville	[49.0]	54.5	43.9	64.2	72.0	80.5	78.6	76.4	71.5	59.3	55.7	44.0	[62.5]
Spartanburg[5]	49.4	52.2	49.0	61.3	68.7	79.4	76.8	76.7	69.8	59.0	54.2	42.6	61.6
Spartanburg[6]	54.2	58.4	48.2	59.6	67.0	76.2	77.9	75.4	72.5	60.8	57.2	45.6	62.8
Statesburg	54.6	56.6	53.6	62.7	70.2	78.5	75.9	74.1	70.9	61.7	58.2	46.8	63.6
Timmonsville				*d*66.7	73.4	*e*82.8	*e*77.4		74.9				
Trial	53.0	54.5	52.0	61.0	74.0	82.0	82.0	79.0	[73.0]	60.1	[57.0]	[47.0]	[64.6]
Walhalla	51.4	54.1	50.6	61.6	67.2	76.6	76.4	75.4	70.5	[49.0]	[45.0]	43.2	[60.1]
Winnsboro	54.4	54.4	49.2	63.1	71.3	[81.0]	81.2	75.8	74.4	59.0	59.0	[46.0]	[64.1]
Yorkville	52.4	53.4	53.0	63.0	70.0	79.0	78.0	74.0	71.0	59.0	55.6	44.0	62.7
South Dakota:													
Aberdeen	[4.0]	[10.0]	22.6	41.0	52.2	67.4	*g*72.8	67.1	54.6	43.4	31.2	22.8	[40.8]
Alexandria	6.9	17.0	26.5	50.4	55.4	71.2	75.8	68.5	60.8	48.0	34.5	25.4	45.0
Brookings	5.0	14.0	20.1	47.9	52.4	66.9	70.8	65.2	57.5	44.2	29.4	21.4	41.2
Canton	13.8	21.3	25.2	51.2	56.2	71.2	75.0	67.8	61.2	49.3	36.1	28.1	46.4
Clark	3.8	11.6	23.2	51.5	54.0	67.4	71.3	65.8	57.2	44.6	33.2	22.7	42.2
Cross			29.4	41.1	52.0	61.7		*f*67.1	*f*58.1		*n*35.8		
De Smet	2.8	10.3	21.4	45.8	50.7	68.6	71.1	65.3	56.6	42.1	29.9	21.1	40.5
Flandreau						69.4	72.0	65.2	59.1	47.1	33.2		
Fort Bennett	4.5	16.2	30.5	53.3	57.4	71.2	77.2	72.1	61.5	50.2	38.0	27.2	46.6
Fort Meade	11.6	20.0	32.0	47.0	54.4	65.6	75.9	70.8	60.3	48.3	39.2	31.9	46.4
Fort Randall	12.8	21.3	30.4	51.0	55.0	71.1	79.2	72.2	64.6	53.8	39.7	30.7	48.5
Fort Sully[7]	2.0	15.0	29.2	51.2	55.8	70.2	77.3	71.8	61.0	49.6	39.0	28.0	45.8
Fort Sully[8]	6.8	17.5	31.3	54.0	58.6	71.8	79.2	73.6	63.0	51.2	40.6	29.2	48.1
Highmore	[1.0]	[12.0]	22.7	49.6	55.0	68.8	76.9	69.1	59.5	47.9	35.7	26.2	[43.7]
Howard								66.0	61.6	48.7	37.0	20.8	
Huron	2.6	13.0	25.0	49.5	54.0	69.2	73.8	68.0	60.2	46.8	34.6	24.4	43.4
Kimball	3.5	12.9	24.2	47.6	54.0	70.8	74.2	67.1	57.8	43.0	30.4	22.4	42.3
Millbank	[4.0]	[10.0]	[23.0]	40.0	47.4	68.6	70.8	64.7	64.7	48.0	37.9	28.9	[42.3]
Oelrichs	[12.0]	[22.0]	33.6	*k*45.5	52.8	[65.0]	74.5	69.4	59.6	46.8	35.4	28.6	[45.4]
Onida	1.2	12.3	23.1	46.0	51.0	[70.0]	73.6	*d*66.2	57.7	44.0	31.9	[27.0]	[42.0]
Parkston	9.2	18.3	25.6	49.5	54.7	68.4	71.2					30.3	
Rapid City	12.8	22.5	33.4	46.7	53.7	65.7	74.5	69.6	59.7	48.8	42.1	33.6	46.9
St. Lawrence								*j*71.5	*d*58.5	*m*45.6		26.6	
Scranton	3.7	10.2	26.6	50.1	55.5	70.4	77.4	69.3	[61.0]	44.6	33.4	25.1	[43.9]
Sioux Falls						72.2	73.5	66.8	59.6	46.8	32.9	24.5	
Spearfish	14.8	21.8	33.2	48.2	54.4	68.0	76.3	72.4	60.3	48.5	43.9	34.7	48.0

[1]N. Helme. [2]C. O. Flagg [3]Office City Engineer. D. W Hoyt [5]J. F. Bayerly. [6]Cotton Belt Observer. [7]Signal Service. [8]U. S. post hospital.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
South Dakota—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
Vermillion	11.2	21.6	25.6	50.2	56.0	71.4	75.0	66.8	57.5	46.0	34.1	26.5	45.2
Webster	5.8	14.6	23.5	49.8	52.7	69.1	72.7	68.2	61.0	47.4	35.3	25.8	43.8
Wolsey	4.1	13.0	26.4	48.6	54.8	71.1	76.1	69.5	60.0	45.7	32.5	24.0	43.8
Woonsocket	3.8	13.2	24.4	48.8	53.5	69.4	74.4	68.3	58.6	44.3	31.2	22.9	42.7
Yankton	11.4	21.0	28.6	51.4	56.2	70.9	75.9	69.6	62.4	49.8	39.2	31.0	47.3
Tennessee:													
Andersonville	48.4	50.1	43.7	58.4	64.5	76.3	75.2	69.6	68.6	53.6	49.4	37.1	57.9
Arlington	......	......	......	......	65.6	76.8	76.9	71.8	67.1	60.3	51.8	......	......
Ashwood	49.8	51.4	46.8	60.2	66.0	78.6	79.6	74.9	69.6	57.5	52.3	43.3	60.8
Austin	50.2	51.4	45.4	61.8	66.6	80.6	81.4	76.1	71.4	58.2	52.9	41.8	61.5
Bolivar[1]	51.0	......	......	......	......	*m*80.9	*m*79.3	*l*75.5	......	61.0	55.0	......	......
Bolivar[2]	......	......	......	......	66.6	78.2	78.4	75.6	67.9	60.2	53.6	......	......
Brownsville	......	......	......	......	70.3	81.6	81.4	77.4	70.6	61.1	53.8	......	......
Chattanooga	50.4	54.0	48.8	62.4	68.0	78.9	78.8	75.0	71.5	59.5	55.8	44.8	62.3
Clarksville	47.4	47.5	44.6	60.0	66.0	79.8	80.2	76.0	69.2	57.8	50.7	40.8	60.0
Cog Hill	53.4	52.0	48.3	62.5	64.4	80.0	81.0	......	70.5	......	......	......	......
Covington[1]	49.4	49.7	48.7	62.2	67.7	78.4	78.6	75.0	69.0	59.6	53.2	44.0	61.3
Covington[2]	......	......	......	......	67.0	80.1	79.8	75.2	68.9	59.8	52.1	......	......
Cumberland Gap	48.0	50.0	40.0	57.5	62.3	73.2	72.5	69.0	67.0	52.6	48.1	37.8	56.5
Dare	......	......	......	......	......	......	75.7	71.8	......	58.9	50.6	......	......
Dyersburg[1]			46.0	61.8	66.0	79.6	79.0	75.2	70.6	......	......	......	......
Dyersburg[2]	47.0	46.2	46.0	61.3	69.4	82.0	81.2	77.5	70.2	60.2	52.3	[42.0]	[61.3]
Fayetteville	52.6	51.6	49.0	62.0	66.9	78.2	78.2	74.6	70.7	58.0	53.1	43.2	61.5
Florence Station	48.6	50.2	46.1	60.2	65.3	78.5	78.6	73.7	69.5	57.2	51.7	41.8	60.1
Franklin					......	......	......	......	69.9	58.8	51.5	41.7	......
Grand Junction	......	......	......	......	67.3	78.9	80.0	76.1	70.1	60.4	54.2	......	......
Greeneville	47.7	49.9	43.2	57.1	62.7	73.0	72.9	69.6	67.3	53.5	48.5	37.8	56.9
Grief	48.2	49.3	47.9	58.0	62.3	74.1	......	71.8	......	......	......	......	......
Hohenwald	49.4	48.2	46.6	58.5	65.8	78.7	79.3	74.9	69.9	57.9	54.2	42.7	60.5
Jacksboro	48.3	50.5	44.2	59.1	64.6	[75.1]	75.3	71.4	68.3	55.7	52.3	39.0	58.6
Kingston Springs	50.7	50.8	47.3	63.0	66.2	[77.0]	81.4	76.6	70.2	[56.0]	52.9	[39.0]	[60.9]
Knoxville	48.8	51.8	45.1	59.8	66.3	77.5	78.0	73.8	70.6	57.0	52.4	40.2	60.1

Lawrenceburg	41.3	49.4	46.7	58.1	62.3	75.0	----	----	----	----	----	----	----
Lewisburg	50.0	50.1	46.2	60.8	65.0	78.2	77.2	73.1	69.5	57.2	50.1	42.0	60.0
Lookout Mountain	----	----	----	----	----	----	----	----	i66.8	i55.6	53.9	41.7	----
Lynnville	48.6	47.8	43.4	57.2	63.1	75.5	77.1	73.0	67.9	[57.0]	[52.0]	44.4	[58.9]
McKenzie	48.9	49.6	47.7	62.8	66.4	81.0	80.0	[76.0]	69.3	61.3	54.0	[39.0]	[61.3]
Memphis	50.8	51.4	49.2	61.8	69.4	80.6	81.0	77.2	70.8	61.8	56.2	46.0	63.0
Milan[1]	47.9	48.2	43.4	60.4	66.0	----	----	----	----	----	----	----	----
Milan[2]	----	----	----	----	67.6	81.3	80.8	76.5	69.8	59.4	52.5	----	----
Missionary Ridge	----	----	----	----	----	77.8	----	71.2	67.0	56.0	52.4	41.8	----
Nashville	49.0	49.2	45.7	60.2	65.8	79.8	80.0	75.2	70.2	59.3	53.6	42.6	60.9
Nunnelly	49.7	49.1	45.7	60.1	65.4	78.0	79.1	76.4	69.4	57.4	54.2	42.4	60.6
Parkville	50.8	53.1	48.0	60.8	66.2	76.4	77.4	73.0	70.0	57.5	52.9	42.7	60.7
Riddleton	49.8	50.6	46.1	59.8	64.8	78.5	78.0	71.3	69.8	57.6	50.7	40.2	59.8
Rogersville	45.9	48.5	42.6	57.2	64.0	75.1	75.6	71.2	68.8	54.0	50.3	36.7	57.5
Rugby	46.1	47.0	41.2	57.3	62.9	75.1	75.3	70.6	66.2	52.3	48.1	38.4	56.7
Savannah	52.6	----	50.0	59.2	66.5	80.3	----	----	70.4	59.3	----	42.5	----
Sharps	[46.0]	51.5	47.7	62.2	67.3	80.0	78.7	73.3	69.1	[59.0]	53.5	44.8	[61.1]
Springdale	49.0	48.9	44.2	59.5	67.2	76.4	78.7	74.6	71.6	57.0	49.3	39.5	59.7
Trenton	47.3	47.0	45.4	59.6	64.7	77.3	77.7	73.4	66.8	56.5	49.6	40.8	58.8
Union City	----	----	----	----	----	----	----	77.0	70.4	60.9	53.6	41.3	----
Watkins	51.0	51.5	45.3	61.0	65.0	80.3	81.0	74.7	71.6	60.0	[52.0]	[42.0]	[61.3]
Waynesboro	50.5	49.5	47.6	59.6	64.8	75.8	76.9	72.1	67.5	56.3	52.0	42.2	59.6
Woodstock	50.5	49.7	48.8	62.6	71.5	81.0	81.9	----	----	----	----	----	----
Texas:													
Abilene	49.8	51.4	56.6	62.1	72.0	78.2	82.8	80.8	71.0	64.8	54.5	49.9	64.5
Austin[1]	58.0	60.6	62.5	68.2	75.6	82.0	85.4	83.6	77.2	68.6	58.6	54.7	69.6
Austin[2]	56.5	59.2	62.6	67.5	76.4	77.2	85.8	85.5	80.2	69.4	59.5	54.8	69.5
Belton	----	----	----	----	75.1	80.2	83.1	84.3	79.6	71.0	65.4	----	----
Berlin	----	----	----	----	----	----	----	----	f74.0	67.4	52.3	51.8	----
Brady	j52.6	k48.7	60.5	63.0	71.1	76.9	82.9	80.4	71.9	j62.2	d54.2	48.7	64.4
Brazoria	63.4	61.9	62.2	68.9	74.3	79.0	80.5	79.4	73.9	68.4	60.4	55.5	69.0
Brenham	[57.0]	63.0	64.9	69.7	76.0	81.1	83.7	83.5	77.0	70.0	61.4	56.8	[70.3]
Brownsville	69.3	68.6	69.6	74.4	78.4	81.0	83.5	83.1	79.8	76.0	67.2	64.8	74.6
Brownwood	53.1	53.5	58.4	65.2	74.1	81.1	86.1	84.2	74.3	66.0	55.5	51.0	66.9
Burnet	----	----	----	----	70.4	78.2	84.3	83.2	75.3	67.3	56.5	53.2	----
Caddo Peak	51.4	52.2	56.7	62.4	71.1	----	----	----	----	----	----	----	----
Camp del Rio	[60.0]	63.2	57.8	62.0	i67.6	[81.0]	j77.4	78.4	70.3	62.2	[59.0]	54.0	[66.1]
Camp Eagle Pass	58.5	64.2	66.6	72.0	77.7	80.9	86.3	86.1	78.8	71.9	61.8	56.7	71.8

[1] Signal Service. [2] Medical Department.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Texas—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
Camp Pena Colorado	51.6	48.7	56.9	64.2	70.4	75.1	78.2	82.2	69.3	62.3	46.2	45.2	62.5
Childress	46.2	48.0	55.2	62.7	72.4	82.8	87.6	84.6	73.8	d67.6	[53.0]	45.5	[65.0]
Coldwater								79.4	65.9	g57.1	43.8	e39.0	
College Station	57.3	62.4	62.0	68.6	72.5	77.8	85.8	83.8	77.6	66.7	61.2	57.6	69.4
Colorado	50.9	[51.0]	58.1	63.9	71.1	f75.7	81.5	81.4	71.6	66.2	55.4	50.5	[64.8]
Columbia	64.9	63.6	60.3	69.8	75.2	80.8	83.2	81.9	76.3	70.6	62.6	57.4	70.6
Corpus Christi	64.0	64.0	65.1	68.6	75.7	79.2	81.3	81.3	78.4	72.3	63.5	58.8	71.1
Corsicana[1]			70.0	65.5	71.3	77.3	82.8	f80.4					
Corsicana[2]	[54.0]	69.0	h65.1	65.5	73.8	79.8	83.2	82.7	74.7	64.8	55.6	52.8	[68.4]
Cuero					i78.4	80.8	86.8	82.7	73.3	65.5	58.7		
Dallas[1]	52.3	55.1	57.5	65.8	76.0	83.3							
Dallas[2]	49.9	55.1	56.4	[65.0]	76.2	82.5	82.3	86.1	76.2	66.8	57.6	[51.0]	[67.1]
Decatur	49.4	50.0	54.3	61.6									
Duval	58.7	60.6	63.0	61.7	75.8	80.8	87.2	84.7	78.5	[72.0]	59.5	53.8	[69.7]
El Paso	48.3	51.8	58.8	64.3	75.2	79.6	82.3	78.8	73.6	63.2	51.2	49.2	64.7
Epworth	46.2	47.1	54.5	60.3	70.9	75.2	82.8	79.9	71.3	62.2	52.7	45.8	62.4
Forestburg	48.2	45.4	52.8	61.8	67.2	75.3	81.8	78.6	70.5	64.2	h57.0	53.4	63.0
Fort Bliss	47.6	51.9	57.5	64.5	75.0	80.2	83.8	80.8	74.8	64.0	51.9	48.3	65.0
Fort Brown	69.5	67.0	68.2	66.0	70.8	77.2	77.6	81.1	78.8	75.0	65.6	[64.0]	[71.7]
Fort Clark	60.1	60.0	[65.0]	69.3	76.0	80.6	84.6	84.2	76.7	68.8	59.3	54.4	[69.9]
Fort Davis	51.0	52.6	63.2	70.9	74.3	73.8	76.3	75.2	67.0	61.5	49.5	48.0	63.6
Fort Elliott[1]	39.0	40.6	47.4	56.4	65.4	74.4	80.4	76.4	66.4	[61.0]	[50.0]	[44.0]	[58.4]
Fort Elliott[3]	40.6	41.6	49.7	57.6	67.0	75.8	81.6	78.1	f74.7	[61.0]	[50.0]	[44.0]	[60.1]
Fort Hancock	42.4	47.4	55.2	63.3	73.1	79.1	82.5	79.0	72.5	57.3	49.2	44.6	62.1
Fort McIntosh	62.3	64.1	67.0	71.7	78.2	81.0	84.8	85.3	79.8	72.8	60.9	58.5	72.2
Fort Ringgold	65.9	66.4	68.0	74.4	81.0	83.9	86.3	86.2	81.6	75.1	60.9	60.8	74.2
Fort Worth	52.1	56.3	62.0				81.0	83.6	73.9	69.7			
Fredericksburg	54.9	54.4	58.8	62.6	70.4	75.5	81.2	80.1	71.9	62.6	55.0	d51.9	64.9
Gainesville	50.9	51.2	55.6	64.5	70.7	79.6	g84.4						
Gallinas	59.5	59.0	62.3	66.8	72.9	77.4	82.2	83.2	74.5	67.8	58.0	54.0	68.1
Galveston	64.0	63.7	62.1	69.8	75.0	80.3	82.7	82.6	77.8	72.0	64.7	58.0	71.1
Graham	48.8	49.6	55.3	62.8	69.9	79.7	85.5	84.8	73.0	63.7	50.6	46.1	64.2

Grapevine	------	------	------	------	------	j83.3	84.0	86.7	74.9	66.0	c56.5	52.6	------
Hartley	38.8	37.8	45.4	52.4	[65.0]	70.3	76.4	74.2	67.5	55.8	43.1	[41.0]	[55.7]
Haskell	------	------	------	66.0	73.2	82.5	89.7	87.4	------	------	------	------	------
Hearne	56.6	56.8	58.5	64.3	74.1	77.4	82.6	78.8	73.8	67.6	57.8	[56.0]	[67.0]
Houston	62.7	62.6	61.2	71.1	77.2	81.4	83.8	82.2	75.6	69.0	60.5	55.6	70.2
Howe	48.8	49.6	54.5	61.1	69.0	78.7	82.4	78.2	------	------	------	------	------
Huntsville	59.4	62.0	61.6	67.5	74.0	80.4	83.6	82.2	72.5	68.3	59.6	[58.0]	[69.1]
La Grange	62.2	61.4	63.6	68.1	73.4	78.4	83.4	81.8	75.5	64.2	61.2	53.9	68.9
Lampasas	54.3	58.1	60.1	65.4	d74.6	77.0	82.4	82.6	d73.3	66.1	57.0	d51.9	66.9
Longview	57.7	57.4	58.1	67.3	74.9	81.4	85.2	83.4	75.9	66.2	57.4	52.8	68.1
Luling	------	------	------	69.3	75.3	79.2	85.4	85.2	77.4	70.5	60.6	------	------
Menardville	52.1	52.2	54.8	62.7	71.5	75.5	82.1	79.5	70.5	63.1	51.8	49.2	63.8
Merkel	45.6	45.4	52.6	60.2	68.4	76.7	82.2	82.0	[71.0]	[64.0]	47.2	[49.0]	[62.0]
Mesquite	49.6	55.1	57.6	64.9	72.4	81.0	85.2	83.8	73.9	64.4	55.6	51.4	66.2
Mountain Spring	[48.0]	[49.0]	58.0	62.8	65.3	[75.0]	85.6	83.0	72.9	65.0	55.6	50.2	[64.2]
New Braunfels	58.4	59.8	64.9	68.0	71.2	[78.0]	80.6	80.4	75.3	68.6	59.3	54.4	[68.2]
New Ulm	60.0	61.0	62.5	68.1	75.6	80.4	84.1	82.5	76.1	69.4	61.0	56.1	69.7
Ochiltree	------	32.1	43.1	53.2	63.2	77.4	79.6	84.0	68.7	------	------	------	------
Orange	------	------	------	------	78.8	78.7	81.7	79.2	74.5	66.6	59.2	------	------
Palestine	55.6	57.7	59.2	66.6	72.3	78.2	82.4	81.4	74.2	66.4	59.2	53.4	67.2
Panhandle	39.7	39.3	47.4	50.9	64.2	74.7	79.2	75.6	o68.8	[62.0]	45.8	c41.4	[57.4]
Pantter	52.5	50.4	58.5	60.6	72.9	81.8	86.8	d86.4	75.8	60.1	55.9	53.0	66.2
Paris	------	------	------	------	72.1	80.0	84.0	82.0	73.8	64.2	56.7	------	------
Pike	------	------	o67.1	h63.4	72.5	81.0	------	------	------	------	------	------	------
Rio Grande City	67.6	68.4	71.2	76.5	81.0	83.6	86.6	86.6	82.2	76.6	65.8	62.0	75.7
Round Rock	[57.0]	58.4	61.7	68.5	74.5	80.5	86.8	85.2	76.4	69.2	59.4	54.2	[61.0]
San Antonio[1]	59.4	60.8	62.6	67.9	74.3	78.4	83.4	83.2	76.1	70.1	60.9	56.7	69.5
San Antonio[3]	60.7	62.3	64.2	67.4	74.3	78.7	83.7	84.1	76.1	70.1	60.9	56.7	69.9
Silver Falls	46.6	47.7	55.8	60.2	69.7	76.1	80.8	77.5	70.4	64.4	52.4	48.3	62.5
Tyler	j50.8	57.8	58.0	65.9	73.5	81.0	84.6	82.8	74.6	65.7	58.0	[53.0]	[67.2]
Venus	------	------	------	------	------	------	------	82.6	73.6	63.8	54.9	49.8	------
Waco	56.0	58.1	60.2	63.7	75.6	80.9	85.6	85.1	76.3	67.2	58.6	52.8	68.3
Weatherford	------	------	------	------	71.6	79.3	86.1	81.6	73.6	66.5	56.6	j54.6	------
Utah:													
Alta	19.8	27.8	------	------	------	------	------	------	51.8	d33.6	30.0	25.6	------
Beaver	26.0	34.3	40.7	49.5	59.8	60.9	70.8	67.8	61.6	45.2	30.0	29.4	48.0
Bingham	------	------	------	------	------	------	------	------	g55.2	f39.6	32.0	28.6	------
Blue Creek	21.1	34.8	41.0	58.3	68.7	73.4	88.0	78.2	67.7	48.8	38.7	31.1	54.1

[1] Signal Service. [2] Medical Department. [3] U. S. post hospital.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Utah—Continued.	°	°	°	°	°	°	°	°			°	°	°
Corinne	20.0	30.6	39.4	53.5	66.2	70.5	84.7	76.7	67.0	46.9	35.6	30.6	51.8
Fort Douglas	29.1	33.6	39.5	51.6	61.3	64.6	79.0	73.0	65.4	49.2	40.6	36.4	51.9
Fort Du Chesne[1]	11.6	29.9	37.8	49.2	60.2	62.3	74.6	69.6	61.4	45.1	34.8	26.8	46.9
Fort Du Chesne[2]	11.5	29.2	37.0	49.4	60.9	63.6	74.3	69.0	60.8	45.5	34.6	26.8	46.9
Kelton	17.4	31.7	40.7	53.0	65.2	70.6	82.2	73.7	64.0	47.6	34.2	33.0	51.1
Lake Park	19.6	31.8	37.9	49.6	59.4	62.8	75.0	69.8	61.8	46.1	36.6	33.0	48.6
Levan	20.2	29.0	35.6	46.6	56.5	62.4	74.9	70.0	61.8	43.7	[35.0]	[30.0]	[47.1]
Logan									60.0	c49.6	40.0	35.8	
Losee	22.2	28.6	36.6	46.5	58.5	63.0	71.8	69.5	59.4	46.1	36.5	30.5	47.4
Moab	30.7	38.8	45.4	55.7	68.8	71.5	82.7	74.6	65.3	49.4	39.8	35.4	54.8
Mount Carmel	23.2	29.2	35.2	41.2	51.0	51.6	72.7	69.3	62.3	50.8	31.2	29.4	45.6
Mount Pleasant	15.0	22.5	26.8	36.5	46.6	50.8	62.4	[69.0]	50.3	36.3	28.4	25.6	[39.2]
Nephi	20.1	29.1	38.4	48.3	58.6	62.0	74.1	68.6	60.2	44.6	35.0	31.4	47.5
Ogden[1]	23.4	30.2	35.6	49.1	61.3	61.8	72.1	69.3	68.0	46.0	37.1	33.6	49.0
Ogden[3]	27.4	36.2	42.4	54.5	67.8	71.7	83.2	75.9	69.8	51.6	37.1	36.0	54.5
Parowan									63.1	49.3	39.7	33.2	
Park City									54.6	a39.8	31.6	27.4	
Promontory	17.9	29.9	38.2	49.9	60.0	62.8	79.0	70.3	71.8	43.1	38.5	33.9	48.8
Provo City									c57.1	c41.5	33.2	29.3	
Richfield	[20.0]	[29.0]	h40.8	50.0	59.4	66.0	74.2	67.7	d60.9	46.2	36.0	f32.0	[48.5]
Salt Lake City	24.8	33.7	39.5	50.4	61.3	64.8	77.8	72.9	65.0	48.6	41.0	36.2	51.3
St. George	37.1	43.6	51.6	60.5	71.4	78.8	86.9	82.0	72.7	60.8	50.5	43.1	61.6
Snowville				46.2	58.9	62.6	74.8		63.2	53.8	49.9	40.5	
Stockton									n58.6	k40.0	30.6	29.0	
Taylors Ranch	20.2	30.2	37.5	47.1	59.0	62.1	n74.6	a68.8	59.7	44.0	34.6	29.2	47.2
Terrace	15.8	29.7	40.0	59.4	68.8	71.8	84.7	78.2	65.9	46.1	38.7	29.7	52.4
Vermont:													
Brattleboro[1]	28.6	29.1	30.2	45.2	57.7	65.8	69.2	69.5	60.2	48.1	36.6	18.4	46.3
Brattleboro[3]	29.1	29.4	30.7	46.7	56.2	64.2	69.3	66.3	58.8	46.9	39.8	19.7	46.4
Chelsea	22.1	24.2	26.4	39.7	51.3	59.8	63.7	61.4	58.2	44.4	31.9	13.0	41.3
East Berkshire	17.2	19.5	25.8	38.7	51.2	62.2	65.8	63.9	57.5	43.9	30.0	11.2	40.6
Hartland	25.6	26.2	28.0	42.2	54.3	62.0	67.5	66.2	c59.0	46.6	35.2	14.2	43.9

Jacksonville	25.7	25.4	27.9	40.8	52.6	62.0	64.6	62.5	55.3	42.4	31.8	15.5	42.2
Lunenburg	21.9	24.7	27.3	40.8	56.9	62.6	69.8	67.2	60.0	48.0	35.2	10.8	43.8
Northfield	20.5	22.2	25.0	39.2	51.8	60.6	62.6	62.4	56.0	44.0	31.6	8.9	40.4
Strafford	22.3	22.1	25.8	41.5	54.4	63.8	68.4	65.9	59.0	45.6	34.6	13.4	43.1
Vernon	28.4	30.6	30.5	47.6	56.7	65.5	69.3	66.8	60.7	47.6	36.1	19.1	46.6
Weathersfield Center	24.8	24.2	26.0	42.0	52.4	61.7	66.2	63.4	57.4	45.2	33.0	14.0	42.5
Virginia:													
Bedford City	44.6	44.0	40.6	53.5	62.0	76.7	74.4	72.8	66.7	55.0	49.0	35.5	56.2
Birdsnest	49.6	50.2	46.4	55.6	66.3	76.3	77.4	75.3	71.2	59.9	51.7	41.0	60.1
Bolar	37.7	36.3	31.5	46.6	54.6	62.9	64.9	64.0	61.2	48.8	43.0	27.6	48.3
Cape Henry	51.8	52.2	49.4	57.2	66.3	75.9	77.1	75.4	72.4	60.8	52.4	42.5	61.1
Casanova	------	------	------	------	------	75.8	75.2	75.5	69.4	57.6	49.3	36.4	------
Christiansburg	43.1	42.9	44.8	[g]55.0	61.4	67.4	68.7	69.6	67.4	54.0	49.4	34.7	54.9
Dale Enterprise	48.1	44.8	41.2	55.0	64.7	78.5	74.7	67.0	59.9	53.3	46.6	31.6	55.4
Fall Creek Depot	------	------	------	------	69.5	79.3	76.8	74.5	70.8	60.2	52.6	39.2	------
Fort Monroe	49.6	48.9	47.2	58.0	67.5	77.5	78.0	76.0	73.0	60.4	51.6	40.6	60.7
Fort Myer	43.1	43.3	41.1	53.6	62.4	73.0	75.3	71.9	66.3	54.8	46.8	32.2	55.3
Lexington	45.0	45.3	41.0	54.6	63.3	73.8	72.8	70.4	67.6	55.0	47.9	33.0	55.8
Lynchburg	47.2	47.2	44.6	57.2	66.3	76.6	75.6	74.0	70.0	57.5	51.4	38.2	58.8
Marion	43.9	45.0	42.0	54.2	62.8	72.5	72.6	68.8	65.2	53.0	[f]46.2	33.8	55.0
Mossing Ford	45.4	44.3	43.4	54.4	67.6	[a]77.0	75.2	73.4	68.2	55.6	48.3	34.4	57.3
Norfolk	51.2	52.4	48.0	57.4	67.4	77.0	77.0	75.2	72.4	61.2	52.8	41.4	61.1
Nottoway	47.1	47.0	44.8	56.1	67.4	77.1	76.7	74.6	70.6	57.0	49.8	[36.0]	[58.7]
Petersburg	46.6	47.1	45.6	56.5	67.8	78.3	76.8	75.8	70.4	58.6	49.4	38.0	59.2
Richmond	48.5	49.9	47.5	57.6	67.1	78.0	74.3	75.8	70.3	62.2	53.9	44.2	60.8
Salem	47.0	46.9	42.4	55.4	64.9	77.1	[69.0]	[72.0]	[67.0]	57.6	53.8	38.9	[57.7]
Smithfield	49.9	51.9	48.1	57.8	67.7	74.1	74.9	72.2	[k]71.0	[56.0]	[48.0]	[35.0]	[58.9]
Spottsville	48.6	50.2	46.8	56.1	------	------	------	------	------	------	------	------	------
Staunton	41.6	[45.0]	40.0	53.4	62.4	73.0	72.1	70.9	67.5	54.8	47.9	34.0	[55.2]
Summit	41.6	42.0	39.8	51.7	61.5	71.5	71.8	70.3	64.8	52.8	44.2	31.6	53.6
Wytheville	------	------	------	------	------	71.9	72.3	68.9	65.9	54.1	49.0	34.5	------
Yanceys Mills	------	------	------	------	------	------	[n]70.9	72.8	68.4	56.0	[g]48.1	35.1	------
Washington:													
Blakely	[illegible].2	35.8	45.0	48.6	57.4	59.6	62.7	62.4	57.3	49.6	46.6	45.4	50.[illegible]
Chehalis	------	------	------	------	52.4	59.2	62.8	64.1	60.6	50.7	46.8	42.6	------
Doe Bay	[25.0]	35.6	43.2	46.6	52.8	55.5	57.6	57.7	55.2	48.6	46.1	45.0	[47.4]
East Sound	------	------	------	------	------	[l]59.2	[l]61.8	62.5	57.4	50.0	47.2	44.9	------
Fort Canby[1]	36.0	38.8	44.0	47.0	54.0	55.8	57.8	58.6	55.4	52.4	51.0	46.5	49.8

[1] Signal Service. [2] U. S. post hospital. [3] Medical Department.

TABLE OF MONTHLY AND ANNUAL MEAN TEMPERATURE FOR 1890, ETC.—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Washington—Continued.	°	°	°	°	°	°	°	°	°	°	°	°	°
Fort Canby'	38.6	42.6	45.9	48.1	55.7	56.9	59.4	59.9	56.6	52.1	51.4	47.4	51.2
Fort Simcoe	[27.0]	[35.0]	[43.0]	56.5	66.8	65.4	72.3	76.9	68.6	54.4	46.2	39.0	[54.3]
Fort Spokane	15.1	22.2	36.0	50.3	60.3	67.6	69.1	69.1	60.1	46.0	35.6	33.2	47.0
Fort Townsend	31.9	34.8	43.1	50.8	54.7	56.3	59.9	61.0	56.4	49.6	46.1	44.8	49.1
Fort Walla Walla	18.4	30.4	42.0	54.2	62.5	64.4	72.8	73.8	63.0	51.0	43.4	42.3	51.5
Lapush	-----	-----	-----	-----	49.4	51.9	54.0	53.6	47.6	41.8	37.8	35.0	-----
Olympia	32.6	36.2	43.6	48.3	56.4	58.0	61.2	61.6	56.1	49.4	46.3	44.2	49.5
Seattle	-----	-----	-----	-----	-----	-----	-----	62.9	57.9	50.1	46.8	45.0	-----
Spokane Falls	17.9	24.4	37.6	48.7	58.1	60.5	68.4	68.6	60.0	47.8	38.4	38.2	47.4
Tacoma	-----	-----	-----	-----	-----	-----	-----	-----	59.4	51.5	47.2	47.5	-----
Tatoosh Island	36.7	38.0	41.0	41.8	45.0	47.4	49.8	[59.0]	51.2	48.7	49.0	46.5	[46.2]
Vancouver Barracks	29.7	37.8	45.5	52.4	60.8	56.7	61.7	63.6	61.7	50.8	45.6	41.8	50.7
Vashon	35.0	36.8	-----	-----	-----	-----	71.3	70.8	64.7	51.9	52.2	-----	-----
Waterville	11.5	18.6	35.4	47.4	57.4	60.1	66.7	68.8	59.0	41.8	36.6	37.2	45.0
Walla Walla	20.6	31.1	42.9	55.6	63.0	65.2	73.2	74.5	66.6	53.4	44.6	43.2	52.8
West Virginia:													
Ella	40.4	40.9	34.0	51.1	59.6	70.7	70.8	67.6	62.2	51.6	44.0	31.5	52.0
Kingwood	36.1	36.6	30.5	45.4	52.6	66.0	70.2	63.6	55.6	[46.0]	41.8	26.4	[47.6]
Mont Alto	[42.0]	[42.0]	[36.0]	*i*48.5	*a*56.6	67.9	68.2	63.5	62.0	46.3	42.4	25.4	[50.1]
Oceana	45.0	45.8	39.2	55.2	62.3	73.7	73.0	68.6	67.3	53.2	[51.0]	[32.0]	[55.5]
Parkersburg	42.4	43.4	36.7	53.5	61.7	74.4	73.2	70.0	65.0	54.6	45.8	32.9	54.5
Pleasant Hill	38.0	37.0	30.2	*e*51.2	57.4	68.5	68.3	65.1	63.2	47.3	38.8	30.6	49.6
Seven Pines	35.8	43.9	35.5	51.2	59.9	71.0	-----	-----	-----	-----	-----	-----	-----
Tannery	42.4	42.4	33.4	51.1	60.6	69.7	73.1	68.2	64.1	52.0	44.8	31.3	52.8
Tylers Creek	47.9	47.5	40.7	54.7	[60.0]	74.8	74.0	67.8	66.5	59.8	51.2	32.3	[56.4]
Wisconsin:													
Beloit	-----	-----	-----	-----	-----	71.2	73.6	70.9	58.1	49.3	38.6	26.3	-----
Butternut	10.5	15.0	18.2	37.4	44.2	64.6	62.8	55.6	47.4	39.2	27.7	18.1	36.7
Cadiz	23.6	25.4	24.8	47.0	53.6	71.8	72.6	65.8	55.0	46.4	36.6	24.8	45.6
Delavan	25.3	26.2	25.1	45.6	52.5	-----	-----	-----	-----	-----	-----	-----	-----
Embarrass	18.1	20.8	22.0	45.8	52.2	71.4	71.2	64.0	57.1	47.8	34.3	22.1	43.9
Fond du Lac	[26.0]	[29.[illegible]]	[26.0]	44.8	51.2	69.9	66.3	63.8	54.5	46.3	35.4	24.0	[44.8]
Glasgow	20.6	24.4	22.4	*e*47.4	50.7	[71.0]	*i*72.9	*j*64.5	60.4	52.0	38.2	*i*29.1	[46.1]

Grantsburg	13.4	17.5	20.2	42.7	47.8	66.6	68.3	60.6	54.8	44.6	36.2	[23.0]	[41.3]
Green Bay	19.0	22.5	22.6	44.2	49.1	69.4	70.4	64.6	57.2	47.7	35.2	24.4	43.9
Greenwood	14.7	21.2	21.7	44.7	47.5	67.7	69.4	61.8	54.7	45.2	32.2	20.8	41.8
Hayward	12.4	19.4	17.4						55.0	46.2	34.8	23.0	
Honey Creek	26.0	28.1	25.2	46.0	54.8	73.4	74.6	66.0	58.4	49.2	37.8	26.8	47.2
Horicon	20.6		23.6	42.2	50.5								
Ithaca								64.0	57.4	47.4	36.8	23.5	
La Crosse	16.8	23.8	25.0	49.8	53.4	71.3	73.2	66.2	58.2	48.8	37.6	26.5	45.9
Lincoln	23.6	24.4	25.8	42.6	49.4	69.6	71.0	62.8	57.7	50.4	37.6	27.2	45.2
Madison	22.6	26.1	25.2	47.0	52.9	70.6	71.7	66.0	57.5	48.2	38.4	26.3	46.0
Manitowoc	26.4	29.0	29.0	44.3	49.6	68.2	69.0	65.2	57.9	50.2	39.9	29.4	46.5
Milwaukee	26.0	29.0	26.6	44.3	50.0	67.9	71.2	65.7	59.2	49.4	39.8	28.1	46.4
Neillsville	13.5	20.3	22.0	43.3	48.3	68.2	70.4	60.2	52.1	43.1	31.6	22.0	41.2
Oshkosh	20.3	25.9	24.7	*e*43.8	*g*50.8	70.2	71.8	65.6	58.1	47.1	36.2	28.6	45.3
Plover								62.2	54.6	46.0	33.3	22.6	
Potosi						74.8	76.0	69.2	61.1	*o*58.2			
Summit Lake	15.9	19.2	19.3	41.5	46.8	71.5	70.3	60.4					
Wauconsta	19.4	22.9	20.0	40.5	48.0	67.2	67.4	59.8	53.7	44.2	[35.0]	[26.0]	[42.0]
Wauzeka	16.4	27.8	27.8	50.4	51.3	[73.0]	78.3	69.4	61.0	47.4	34.7	22.4	[46.7]
Weston				41.2	47.2	65.3						*e*21.4	
Wyoming:													
Camp Pilot Butte	10.9	23.2	32.8	42.6	54.5	*f*56.7	70.0	63.4	55.4	42.1	27.8	16.9	41.4
Camp Sheridan	10.0	17.7	[30.0]	39.0	49.7	54.5	65.9	60.6	52.6	[37.0]	[29.0]	27.7	[39.5]
Carbon	19.0	22.6	30.6	41.1	53.3								
Cheyenne	24.8	28.2	35.0	43.2	51.7	61.0	70.2	64.2	56.8	45.3	37.8	36.1	46.2
Fort Bridger	10.2	22.4	30.4	40.8	53.2	55.2	66.7	62.1	54.8	[50.0]	[30.0]	[25.0]	[41.7]
Fort D. A. Russell	19.6	24.2	33.2	46.2	52.1	62.0	70.8	65.0	58.6	41.5	34.7	33.3	45.1
Fort Fetterman					54.8	67.1	75.6	65.9	56.5	42.9	28.9	29.2	
Fort McKinney[2]	15.8	23.0	35.5	45.0	51.8	60.2	72.2	67.6	59.1	46.5	41.6	34.8	46.1
Fort McKinney[1]	13.4	22.0	35.0	45.6	54.0	62.0	73.3	67.9	59.6	45.4	42.2	36.2	46.4
Fort Washakie[2]	11.2	25.4	34.2	42.4	52.3	59.0	69.4	63.8	56.0	41.7	33.1	28.7	43.1
Fort Washakie[1]	11.9	26.8	34.4	45.4	48.7	60.3	69.9	67.7	57.2	42.8	34.5	28.7	44.0
Lander	11.0	25.6	34.5	45.0									
Laramie									52.9	38.7	29.2	29.6	
Lusk	17.0	23.0	33.0	44.4	50.5	*c*63.8	71.4	65.6	55.0	44.7	36.5	32.2	44.8
Owen					49.6	58.8	68.5	62.3	52.7				
Saratoga	16.6	22.6	30.9	41.9	52.3	61.2	71.3	62.5	[53.0]	38.6	26.5	24.0	[41.8]
Wheatland	6.6					59.0	69.3					17.4	

[1] U. S. post hospital. [2] Signal Service.

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND ANNUAL RANGE
SERVICE OBSERVERS, VOLUNTARY AND STATE WEATHER SERVICE OBSERV
METEOROLOGICAL SOCIETY, AND OPERATORS AND AGENTS OF THE PACIFIC

[NOTE.—Letters of the alphabet denote number of days missing

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Alabama:	°	°	°	°	°	°	°	°	°	°
Auburn	76	28	79	29	81	18	83	42	88	43
Bermuda	80	26	81	31	81	21	82	41	86	47
Butler	76	26			82	20	85	42	87	44
Carrollton					77	20	84	44	87	46
Chepultepec									76	51
Citronelle	84	26	83	33	84	22	88	48	92	46
Columbiana	74	25	79	26	80	17	85	36	88	38
Decatur[1]										
Double Springs	74	22	77	24	76	14	85	36	91	34
Elkmont	75	17			75	17	81	31		
Eufaula									88	46
Evergreen									91	[1]50
Florence					74	18	85	41		
Fort Deposit									[e]91	[e]44
Gadsden	76	27			77	18	87	43	92	58
Goodwater										
Greensboro	76	31			79	20	84	48		
Guntersville					77	22	85	32	87	47
Jasper					78	23			84	40
Livingston[2]	78	27	81	31	82	20	85	44	87	45
Livingston[1]									88	42
Marion									88	37
Mobile	77	33	76	36	78	25	84	48	87	54
Montgomery	78	29	81	30	84	21	86	44	89	45
Mt. Vernon Barracks	81	25	82	31	82	20	86	42	90	45
Mt. Willing					80	22	84	43	86	46
Opelika									93	42
Pine Apple									95	43
Selma[2]									91	49
Tuscumbia[3]	75	23			75	19	85	45	88	45
Tuscumbia[1]									90	38
Union Springs					70	20	80	51	85	55
Uniontown							86	45	87	48
Valley Head	72	22	76	24	74	10	80	42	90	38
Wiggins	81	26	83	33	84	20	89	36		
Alaska:										
Juneau	38	— 4	38	— 2	46	10	48	13	68	36
Killisnoo	40	1	41	1	46	16	56	15	71	31
Arizona:										
Agua Caliente	87	20	93	25	89	39	98	40	105	48
Arizona Canal Co. Dam										
Ash Springs	59	26	60	33		38		38		64
Bangharts			69	18	80	22				
Benson	74	27	75	27	83	32	87	42	97	62
Bisbee										
Casa Grande	94	30	84	40	93	44	95	45	106	68
Cooleys Springs										

[1] Cotton belt. [2] Prof. J. W. A. Wright. [3] Voluntary observer.

OF TEMPERATURE FOR 1890, COMPILED FROM REPORTS OF REGULAR SIGNAL ERS, UNITED STATES POST SURGEONS, OBSERVERS OF THE NEW ENGLAND RAILWAY SYSTEM.

from the record; thus, "c" indicates that *three* days are missing.]

June.		July.		August.		September.		October.		November.		December.		Annual.
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
95	62	95	67	90	64	88	56	84	36	78	33	70	28	77
96	68	97	71	90	64	89	56	85	36	81	30	76	24	76
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
90	67	91	71	87	63	84	56	-----	-----	-----	-----	-----	-----	---
80	63	87	68	92	61			-----	-----	-----	-----	-----	-----	---
99	65	98	68	96	62	95	53	93	37	85	32	80	29	77
98	62	95	62	93	55	91	54	84	29	80	25	69	22	81
98	58	100	62	94	50	94	50	85	26	78	23	-----	-----	---
95	62	-----	-----	91	53	87	56	79	30	68	28	69	21	---
98	64	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
98	56	96	61	97	58	90	54	87	47	80	36	-----	-----	---
103	[c]61	100	66	94	59	93	53	87	34	81	28	-----	-----	---
97	68	96	65	94	20	92	50	85	30	-----	-----	-----	-----	---
98	66	100	68	[n]92	[n]59	-----	-----	89	38	81	30	-----	-----	---
99	63	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
96	70	96	72	90	72	91	62	-----	-----	-----	-----	-----	-----	---
96	68	94	72	92	64	90	54	80	32	-----	-----	69	28	---
94	55	94	55	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
94	50	94	68	86	56	86	55	83	31	79	28	69	25	---
97	64	95	65	89	70	87	51	84	34	81	29	72	24	77
98	52	95	57	93	57	88	52	86	33	[g]80	[g]27	-----	-----	---
99	59	98	64	97	55	92	50	87	30	81	27	-----	-----	---
97	67	96	69	91	65	90	54	86	41	81	36	76	31	72
98	66	97	69	92	61	91	57	88	37	82	33	73	29	77
101	63	98	64	94	60	95	49	90	35	85	28	78	23	81
98	66	96	75	93	60	88	60	84	31	-----	-----	71	31	---
[c]99	[e]64	105	64	97	58	93	52	83	30	78	29	-----	-----	---
100	64	99	66	95	55	97	53	86	33	-----	-----	-----	-----	---
100	65	100	69	95	58	93	56	89	34	83	30	-----	-----	---
97	68	-----	-----	-----	-----	-----	-----	85	34	74	29	73	23	---
100	62	98	62	94	52	88	48	84	28	78	26	-----	-----	---
95	73	94	72	92	70	97	52	86	43	78	39	71	32	---
96	65	97	68	93	62	90	57	87	36	81	31	74	28	---
96	60	97	61	92	50	90	50	85	24	82	23	68	20	87
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
77	42	74	42	70	43	65	36	59	30	60	30	45	10	81
75	38	71	42	70	40	69	36	50	30	47	30	45	16	74
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
				107	70	105	66	96	45	93	39	76	37	---
-----	70	-----	68	-----	68	-----	63	-----	-----	-----	-----	-----	-----	---
95	40	-----	-----	91	56	87	51	78	30	64	24	74	22	---
98	71	-----	-----	98	70	90	64	83	46	80	35	68	34	---
93	55	95	59	84	56	85	54	75	41	73	28	70	32	---
106	70	113	76	108	74	108	73	100	55	98	48	87	45	83
-----	-----	[h]92	[h]46	85	44	80	40	[e]71	[e]24	-----	-----	-----	-----	---

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°
Arizona—Continued.										
Dragoon Summit	....	....	....	....	....	....	....	....	....	....
Eagle Pass (Curtis)	....	16	....	22	....	24	....	38	....	53
Florence	78	25	....	....	89	25	96	43	108	48
Fort Apache[1]	69	9	80	11	74	11	80	31	94	36
Fort Apache[2]	71	8	75	11	74	15	80	30	93	34
Fort Bowie[1]	68	19	72	21	76	21	81	33	92	52
Fort Bowie[2]	68	18	73	20	77	24	82	32	93	52
Fort Grant[1]	73	19	74	22	76	20	79	31	92	50
Fort Grant[3]	73	19	74	22	76	24	79	31	92	50
Fort Huachuca	62	11	64	21	....	23	83	32	95	47
Fort Lowell	86	20	87	21	89	21	94	39	105	44
Fort McDowell[1]	82	24	89	25	85	29	98	41	108	45
Fort Mojave	74	26	80	30	85	37	98	40	107	51
Fort Thomas	74	19	80	18	83	22	90	37	103	44
Fort Verde[1]	71	17	....	19	....	24	86	35	100	41
Fort Verde[2]	70	17	75	18	76	24	86	34	99	42
Gila Bend[3]	68	34	66	34	80	42	90	52	102	54
Gila Bend[4]	....	....	....	....	....	....	....	....	....	....
Holbrook	66	23	74	9	81	13	81	31	92	33
Lochiel	75	12	74	22	79	26	....	....	....	....
Maricopa	83	37	83	34	97	43	98	52	106	64
Mount Huachuca	76	15	78	24	88	26	92	34	[d]99	[d]47
New River	....	....	....	....	....	....	92	38	100	45
Pantano	78	27	78	32	83	33	95	40	100	58
San Carlos	74	20	77	20	82	26	90	38	102	41
San Carlos	78	16	88	18	90	23	[b]90	37	....	41
San Simon	99	28	96	30	90	35	90	40	105	55
Signal	72	25	79	27	82	32	94	39	105	47
Texas Hill	79	22	89	22	90	48	100	58	110	68
Tombstone	....	....	73	24	....	....	....	....	99	50
Tucson[5]	76	24	79	26	88	28	94	41	105	50
Tucson[4]	70	35	63	43	84	40	96	41	98	49
Whipple Barracks	....	....	....	....	....	....	....	....	....	....
Whipple Barracks (Prescott)	63	—3	73	9	69	20	78	28	86	34
Wilcox[4]	84	25	82	25	84	26	85	40	101	50
Wilcox[2]	78	18	80	15	84	21	88	30	100	38
Yuma[4]	74	39	90	42	85	50	91	60	98	65
Yuma[2]	80	30	86	36	90	44	98	46	106	54
Arkansas:										
Brinkley	....	....	....	....	....	....	....	....	88	40
Camden	....	....	78	24	83	19	81	41	87	48
Conway	77	22	78	20	82	19	81	40	89	52
Dallas	....	....	79	8	78	20	72	42	87	55
Devalls Bluff	....	....	....	....	....	....	....	....	92	44
El Dorado	....	....	....	....	....	....	....	....	....	....
Fort Smith	80	14	78	7	82	15	88	39	89	46
Forrest City	78	24	76	26	80	22	84	44	88	48
Harrisburg	75	18	74	20	80	11	83	30	88	44
Heber	76	19	....	....	81	14	84	40	89	48
Helena[6]	....	....	....	....	....	....	....	....	90	48
Hot Springs	75	18	78	26	....	14	....	37	....	43
Lead Hill	81	11	81	5	82	9	98	38	96	42
Little Rock	75	21	78	20	84	16	84	38	87	46

[1] U. S. post hospital.
[2] Signal Service.
[3] Daniel Murphy.
[4] Pacific Railway System.
[5] E. L. Wetmore.
[6] Cotton belt.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
				89	61	91	62	80	62	76	40	78	32	---
	56		67		60		58		36		28		26	---
107	48	115	67	107	60	105	60	91	37	89	34			
94	38	97	54	91	51	91	44	83	28	79	20	66	21	88
93	37	97	53	90	55	88	46	78	28	73	19	62	20	89
93	56	94	56	88	56	85	52	76	43	78	28	61	24	75
95	56	[b]95	58	90	55	86	52	76	42	72	26	61	30	77
92	54	96	60	90	54	93	40	78	39	72	26	67	30	77
92	54	96	60	90	54	89	55	78	39	77	24	67	30	77
94	52	98	58	89	54	89	53	80	40	77	29	67	27	87
108	44	109	65	101	63	101	54	98	35	98	24	83	25	88
108	50	117	69	110	68	108	60	97	39					---
109	57	120	72	112	70									
105	45	108	63	101	62	98	52	90	35	78	23	66	24	90
102	46	109	60	104	58	[e]102	[e]50							---
102	48	109	63											
104	72	110	80	104	78	102	74	88	56	82	50	88	52	76
				110	82	116	78	100	55	83	50	82	50	---
96	33	101	54	95	53	89	43	75	24	72	20	59	19	92
[g]93	[l]58	90	65	85	62	87	56	77	42	74	30	67	30	---
112	73	116	90	105	78	101	70	81	61	80	52	72	40	82
95	43	96	60	85	51	84	51	83	38	74	27			---
106	49	108	67	104	60	103	[l]35	86	40	85	40	76	39	---
103	75	110	63	102	63	103	57	98	53	80	48	73	37	83
103	48	109	63	101	62	100	56	84	38	79	30	66	28	89
105	46	111	64		62		56		35	91	26	78	23	---
104	48	100	60	101	62	106	65	100	46	91	35	80	28	78
105	52	112	70	106	68	104	64	90	43	86	33	71	35	87
114	75	119	80	114	75	111	72	92	50	90	42	76	36	97
99	56	102	60	96	57	95	54	86	40					---
105	52	109	69	99	66	99	60	89	41	87	34	72	35	85
107	85	107	78	104	70	96	79	93	64	75	40	72	40	72
				90	50	92	45	82	26	78	19	64	20	---
88	33	93	53	88	50	90	44	72	[q]27					---
101	58	104	60	98	60	97	60	85	50	81	25	69	28	79
99	39	104	60	96	44	94	45	87	30	78	14	68	20	90
101	74	108	82	103	82	103	75	92	55	83	52	74	43	69
107	61	115	74	110	68	110	67	95	47	91	40	77	35	85
94	58	95	60							76	30			---
91	61	95	63	94	63	91	52	84	37	79	33	74	23	72
92	64	92	67	92	62	90	50	82	34	73	32	70	26	---
96	59	96	73									64	20	---
96	56	98	60	94	50	92	49	85	26	77	25	74	18	---
100	58	101	58	98	60	91	44	88	32	81	30	77	20	94
98	60	98	64	94	58	90	50	86	32	79	32	75	28	76
93	64					86	48	85	28	76	25	67	20	---
96	59													---
100	60	100	60	98	58	92	50			78	32	72	14	---
	55	96	58	98	57	95	45	87	31	71	31	69	21	84
106	57	106	62	104	58	98	46	91	30	80	26	76	2	104
94	60	97	66	94	61	92	51	86	38	77	33	74	22	81

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°
Arkansas—Continued.										
Little Rock Barracks	77	21	79	20	84	16	87	38	90	45
Lonoke	76	23	77	22	----	----	87	41	89	50
Malvern	----	----	----	----	----	----	----	----	88	42
Newport[1]	----	----	----	----	----	----	----	----	92	32
Osceola	----	----	79	28	78	15	80	35	89	43
Ozone	69	13	70	7	70	12	80	33	83	45
Pine Bluff	76	22	80	24	78	18	88	40	92	42
Prescott	----	----	----	----	----	----	----	----	90	50
Russellville	----	----	----	----	----	----	----	----	91	44
Stuttgart	78	20	79	21	82	15	84	38	89	47
Texarkana	80	20	80	10	85	21	85	40	94	48
Washington	78	21	78	19	84	17	88	39	100	49
Winslow	66	10	72	—4	66	8	75	45	80	42
California:										
Alcalde	63	25	68	33	----	----	89	40	104	50
Alcatras Island	56	33	62	36	65	40	71	45	73	40
Almaden	60	29	72	28	76	37	84	41	94	46
American Hill	----	----	----	----	----	----	----	----	----	----
Anaheim	70	32	80	34	78	44	92	50	92	60
Anderson	50	14	67	26	82	32	----	----	----	----
Angel Island	58	29	67	31	72	36	81	39	80	42
Antioch	61	25	68	35	65	37	78	48	99	50
Aptos	60	27	68	28	73	32	----	----	75	50
Athlone	68	27	76	34	81	36	93	43	102	51
Auburn	59	26	70	24	72	34	81	45	99	45
Bakersfield	63	30	67	33	77	36	88	48	103	58
Barstow	67	22	77	23	77	29	91	38	104	40
Beaumont	52	27	68	24	74	40	82	47	90	50
Belmont	60	28	65	31	70	37	82	45	94	47
Benicia Barracks	60	27	67	29	69	35	83	42	100	45
Berendo	60	25	68	30	77	40	93	42	103	55
Berkeley	58	31	61	32	68	38	77	41	82	45
Bishop Creek	61	10	72	21	75	31	----	----	99	49
Boca	53	—30	60	—26	60	—10	----	----	88	29
Borden	58	25	75	31	79	38	90	45	105	50
Boulder Creek	68	23	70	26	80	29	90	29	100	38
Brentwood	62	28	67	35	73	42	90	50	101	40
Brighton	62	30	72	32	72	40	90	51	96	52
Byron	58	26	63	30	70	38	80	48	----	----
Caliente	60	35	70	33	75	32	93	35	103	40
Calistoga	55	23	65	24	72	30	84	36	----	----
Castroville	57	30	65	33	71	37	87	42	74	50
Centerville	67	34	74	40	77	46	89	53	100	54
Chico	59	28	66	28	72	36	86	46	98	50
Cisco	35	10	40	10	39	21	50	26	57	32
Colfax	53	20	68	24	64	32	80	40	92	42
Colton	70	26	92	30	84	38	88	44	94	48
Corning	65	28	78	28	78	30	89	48	100	50
Davis	60	31	72	31	73	38	89	42	97	48
Delano	64	28	69	30	78	33	94	42	105	52
Delta	50	20	65	23	70	32	84	43	96	42
Downey	67	32	82	40	79	47	91	58	93	56
Dunnigan	58	31	68	33	68	37	88	45	103	47
Dunsmuir	43	26	52	24	----	----	62	27	100	45
Edgewood	40	2	----	----	60	23	67	35	87	43

[1] Cotton belt.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
97	56	99	62	99	59							70	23	---
100	61	100	65	91	58	94	54	86	35	78	34			---
96	50	96	60	94	60	90	58	84	52	78	38	67	15	---
96	58	97	58	93	55	91	47	86	28	75	30	70	20	---
94	60	96	56	100	55	90	46	87	28	76	29	66	19	85
91	58	92	61	90	59	85	46	79	34	70	32	72	22	80
98	64	98	64	96	60	96	50	86	34	80	34			
94	60	96	65	94	64	89	51	81	38	76	36	72	22	---
100	58	99	62	96	60	92	48	84	33	84	30	72	21	81
96	62	96	58	96	52	92	47	85	26	79	30	78	23	88
96	60	98	62	98	60	96	48	86	35	81	32			
91	60					93	51	86	35			70	16	95
91	60	84	68	84	65	80	42	84	33	73	32			
107	58	110	65	105	65	101	60	85	50	82	40	65	30	---
70	38	65	40	68	43	74	45	85	45	73	45	61	26	59
91	50	93	50	93	53	88	55	86	45	80	36	67	35	66
107	64	98	66	104	62	95	60	100	56	90	46	79	46	75
												65	27	---
81	44	79	45	83	47	82	49	91	40	79	42	70	35	54
94	60	107	66	94	68	84	61	82	54	83	40	68	36	82
78	45	85	50	90	50	72	48	90	38	80	35	70	32	---
102	57	110	64	110	60	104	57	92	40	85	37	75	34	83
93	34	105	54	98	55	94	52	87	40	84	38	60	35	81
103	62	109	75	103	71	99	64	86	48	83	42	71	32	79
104	48	114	59	106	58	104	52	89	37	82	32	74	28	92
98	63	105	70	97	60	87	60	90	40	84	40	74	40	81
88	54	94	56	90	54	88	52	85	42	80	38	65	32	66
92	47	99	51	97	51	92	50	89	45	78	39	63	33	73
104	60	113	62	108	62	108	57	85	52	80	38	66	35	88
82	46	82	50	83	52	83	49	86	46	74	43	66	34	55
104	58	111	73	103	62	98	53	85	40	82	33	60	23	---
		98	33	92	28	90	34	83	22	70	8	60	0	---
110	55	114	65	106	65	103	63	90	49	85	35	75	35	89
98	40	110	39	108	42	100	31	96	29	84	28	74	25	87
		112	75	100	62	90	60	87	48	80	39	61	31	---
91	58	106	62	100	63	98	58	94	50	85	36	76	35	76
94	60	105	66	100	62	94	56	84	50	80	34	70	30	78
100	60	108	60	102	70	98	55	88	43	80	35	74	27	---
95	50	105	50	93	48	96	48	88	34	82	28	72	40	57
72	50	73	53	78	51	74	50	87	42	83	40	65	38	66
94	54	99	59	*98	*60	*94	*56	*93	*48	82	43	70	33	83
104	53	111	60	104	60	92	56	92	47	88	40	48	20	77
80	31	87	51	82	50	76	45	65	29	64	27	70	33	82
96	44	102	56	98	58	94	56	87	40	82	36	86	34	84
106	56	110	66	108	56	108	56	100	39	92	38	74	30	85
104	50	113	61	111	65	95	61	85	50	92	35	72	35	---
98	50	105	55			96	48	87	42	82	32	68	32	83
105	58	111	67	105	62	104	61	89	44	82	42	69	30	86
102	52	106	52	103	55	97	48	88	35	86	33			
99	59	96	61	98	60	91	60	94	52	88	46	56	30	86
108	56	116	67	106	63	96	58	88	49	78	36	65	30	---
96	42	96	62	91	62	93	56	84	44	78	35			---
91	45			101	61	85	43	69	30	67	24			

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
California—Continued.	°	°	°	°	°	°	°	°	°	°
El Dorado	59	22	72	29	73	34	83	45	97	48
Elmira	60	31	72	32	75	40	88	48	102	50
El Verano	58	27	66	28	69	34	80	44	95	49
Emigrant Gap	39	15	48	22	43	18	55	28	80	32
Esparto									102	48
Esperanza	57	28	67	31	70	40	86	50		
Eureka	54	28	59	27	60	31	63	35	78	41
Farmington	61	25	73	28	80	35	81	45	99	52
Felton	56	26	70	30	79	32	90	40	98	42
Florence	72	35	83	35	85	49	90	50	84	50
Folsom	58	26	68	31	75	40	82	45	100	52
Fort Bidwell	42	—20	51	—12	60	6	77	20	86	32
Fort Gaston	52	27	57	24	71	32	85	31	101	38
Fort Mason	63	35	61	35	65	40	78	41	49	46
Fresno[1]	66	29	74	30	80	40	88	47	108	50
Fresno[2]	58	24	70	28	77	33	92	36	103	42
Fruto	56	26	68	30	70	34	85	46	99	51
Galt	59	29	70	29					100	35
Georgetown	50	18	63	18	65	29	78	34	89	38
Gilroy	60	26	68	28	73	38	85	49	95	49
Girard	52	17	65	25	68	30	84	37	90	40
Glen Ellen	60	23	75	24	75	33	85	41	100	49
Goshen	60	26	70	28	76	34	88	43	103	53
Haywards	54	30	63	32	62	36	78	45	85	49
Hollister	74	28	85	30	83	32	90	45	92	48
Hornbrook	48	— 8	58	10	68	28			94	42
Hydesville	53	24	63	24	64	29	70	29	86	39
Indio	75	29	98	30	92	40	102	55	110	64
Ione	56	21	60	24	72	32	84	40	95	50
Iowa Hill	50	22	67	22	69	31	83	41	91	40
Jolon		22				41		48	88	50
Julian	66	24	78	28	72	35	80	35	83	43
Keeler[2]	60	22					86	50	95	58
Keeler[1]	59	16	67	19	74	28	80	35	94	39
Keene	60	21	65	28	70	32	82	41	94	48
King City	58	22	70	22	82	30	83	35	98	42
Kingsburg	59	25	62	30	72	35	90	48	97	55
Knights Landing	64	31	66	36	68	40	78	48	85	50
La Grange	58	27	70	20	73	34	91	39	104	46
Lathrop	59	30	70	32	73	40	90	43	97	49
Laurel	58	29	70	31	75	37	87	45	93	47
Lemoore	75	25	80	30	78	34	96	38	101	53
Lewis Creek	66	26	68	33	75	36	89	42	100	51
Livermore	68	22	80	30	82	37	86	36	100	42
Livingston	66	30	65	28	78	35	86	43	99	50
Long Beach	79	32	88	38			90	46		
Los Angeles[2]	65	32	82	35	84	42	94	48	98	48
Los Angeles[1]	67	34	81	35	81	40	94	42	96	43
Los Banos	58	24	68	35	75	35				
Los Gatos[2]	58	26	73	30	78	36	85	50	98	50
Los Gatos[3]	60	27	70	30	74	35	82	38	94	42
Mammoth Tank	80	29	84	41	92	50	100	60	111	65
Martinez	58	28	59	28	66	40	74	42	92	50
Marysville	60	30	62	39	70	40	90	50	98	50

[1] Signal Service. [2] Pacific Railway System. [3] F. H. McCullagh.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
101	54	106	61	----	----	101	54	89	45	85	32	69	31	---
100	58	110	60	103	60	100	52	90	47	90	40	75	32	79
92	54	100	55	95	52	87	50	84	38	79	32	63	32	73
85	34	92	48	86	52	80	46	72	29	71	35	54	22	77
102	55	105	64	98	60	95	55	91	46	80	38	64	28	---
----	----	----	----	----	----	----	----	----	----	----	----	----	----	---
65	45	65	48	65	45	69	46	70	38	66	35	66	36	51
99	55	108	63	102	61	102	58	92	45	83	35	68	34	83
98	48	100	54	98	54	98	50	95	35	90	26	76	27	74
92	55	92	64	97	64	90	58	95	48	91	42	87	40	62
100	58	108	62	102	65	100	60	95	48	86	40	75	30	82
91	33	98	40	91	44	88	36	----	----	----	----	----	----	---
105	41	103	44	102	41	98	39	82	31	70	25	54	28	81
72	45	73	47	76	48	76	49	81	45	73	44	62	36	46
102	60	112	65	108	61	104	59	90	50	82	38	76	32	83
104	46	111	56	105	56	103	53	88	42	82	37	70	28	87
----	----	108	66	104	62	98	51	91	41	85	40	70	26	---
100	50	110	58	100	58	96	55	95	45	94	37	70	30	---
89	38	98	52	94	49	89	50	82	38	77	32	66	29	80
93	53	99	54	94	52	97	50	92	40	84	30	68	30	73
93	45	99	62	97	65	93	55	85	35	76	30	62	33	82
95	49	----	----	98	51	95	43	90	34	80	31	61	30	---
100	55	110	66	108	62	104	60	86	50	85	42	70	29	84
84	54	87	52	85	55	79	52	76	42	68	36	60	35	57
89	50	101	52	98	52	90	48	92	39	83	34	78	28	73
98	40	99	55	96	48	92	48	75	30	72	22	54	18	---
78	39	72	45	76	39	81	39	----	----	----	----	63	30	---
111	65	120	78	114	75	115	68	107	55	98	40	90	40	91
98	52	105	60	100	60	96	54	86	40	80	30	66	25	84
94	47	101	62	96	56	93	54	86	45	82	36	67	33	79
----	56	113	64	106	64	----	----	----	----	----	----	----	----	---
91	45	96	57	87	60	89	54	77	42	75	37	65	34	72
98	58	105	80	100	75	95	60	78	55	77	40	65	32	---
96	46	103	66	98	59	97	50	80	38	77	33	61	29	87
95	47	102	65	98	63	92	55	84	38	75	34	65	31	81
92	48	100	46	96	46	100	42	99	32	89	28	72	28	78
102	56	106	70	105	62	98	58	86	40	78	35	66	30	81
90	58	102	58	94	60	92	55	84	49	72	38	70	37	71
104	47	112	56	111	55	107	54	92	42	85	38	----	----	---
98	58	105	63	99	60	88	55	85	45	85	35	65	35	75
94	49	101	52	95	50	94	48	93	40	89	35	79	33	72
105	55	110	65	110	60	100	60	85	42	80	35	70	32	85
g101	g55	e101	e66	100	61	----	----	----	----	----	----	----	----	---
94	47	102	50	98	56	98	54	90	48	80	38	72	34	80
102	55	109	62	106	60	103	56	92	44	80	37	----	----	81
102	60	80	62	90	60	89	60	96	50	93	38	80	41	---
106	55	97	63	99	61	93	60	96	46	92	43	83	42	74
105	48	97	55	98	56	94	54	99	46	96	41	82	43	71
----	----	104	68	103	69	98	60	80	52	76	34	69	34	---
94	58	101	50	95	55	90	50	88	46	77	35	72	32	75
93	40	----	----	93	45	91	44	85	41	77	36	62	33	---
112	72	118	78	116	75	115	75	96	52	94	52	78	40	89
90	54	92	56	82	54	82	50	82	47	72	35	62	30	64
90	60	100	65	100	69	90	60	----	----	----	----	90	35	---

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
California—Continued.	°	°	°	°	°	°	°	°	°	°
Menlo Park	63	28	65	30	74	36	82	40	96	47
Merced	60	30	72	32	75	38	83	43	101	56
Modesto	55	21	66	25	70	31	85	44	96	49
Mojave	75	24	72	23	78	34	91	42	105	46
Monson										
Montague	48	— 6	58	24	60	36	90	44	98	50
Monterey	64	28	60	32	72	32	74	40	76	44
Monterey (Hotel del Monte)	62	29	68	28	70	35	80	42	80	47
Mount Hamilton	55	17	61	18	60	25	71	31	80	30
Napa City[1]	57	25	65	25	56	32	84	40	99	50
Napa City[2]	53	26	60	30	64	32	76	38	91	42
National City (Sweetwater Dam)	69	30	79	35	76	38	84	40	79	55
Newark	64	28	68	34	68	38	78	45	92	55
Newhall	72	21	83	28	82	34	91	42	95	42
Newman	61	30	68	34	70	40	86	48	96	50
Niles	60	29	74	32	71	36	82	45	92	50
North Hill Vineyard	55	28	67	[illegible]	69	39	80	44	96	47
Norwalk	66	30	82	36	83	45	89	45	99	50
Oakland[3]	57	31	63	30	75	37	87	42	87	47
Oakland[1]	58	32	66	32	66	40	82	48	74	54
Ogilby					101		101	56	110	67
Ontario	83	30	83	40	81	46	93	51	99	40
Orland	62	30	68	30	74	38	94	50	105	47
Oroville			64	30	75	38	86	44	101	46
Pajaro	60	32	70	30	75	35	89	42	80	42
Pasadena	68	29	77	29	77	35	87	37	92	37
Paso Robles	55	23	66	23	76	29	84	38	88	43
Petaluma	58	28	72	30	69	36	84	46	100	52
Placerville[1]	55	18	69	25	70	34	77	33	91	37
Placerville[4]	57	14	68	16	68	26	77	33	97	42
Pleasanton	63	27	76	30			65	35	92	38
Point Reyes Light	59	32	63	34	65	39	68	42	82	40
Pomona	67	27	70	32	71	38	103	37	95	55
Porterville	68	30	68	32	87	37	87	45	108	56
Puente	68	32	79	35	77	36	90	49	94	54
Ravenna										
Red Bluff[1]	58	28	85	33	75	37	90	48	98	46
Red Bluff[5]	54	22	66	28	69	34	87	40	99	42
Redding	54	20	68	30	75	38	93	46	108	48
Riverside	66	26	82	28	83	32	93	36	96	38
Rocklin	60	30	70	35	75	37	85	42	104	50
Rumsey	58	28	70	31	75	37	82	49	98	52
Sacramento[6]	58	21	68	25	72	30	78	35	98	42
Sacramento[6]	58	32	64	34	69	40	73	49	84	53
Sacramento[6]	58	29	67	32	69	36	80	44	92	46
Salinas[7]	[d]58	[g]30	[f]69	32	75	36	86	42	76	48
Salinas[1]	59	30	63	30	67	38	84	47	80	48
Salton	78	22	84	30	90	39	100	51	110	57
San Ardo	61	25	70	27	78	34	90	40	99	50
San Diego	66	35	77	38	74	41	85	45	75	46
San Diego Barracks	65	34	78	39	77	41	84	44	76	49
San Fernando	66	26	85	29	82	43	89	43	94	50

[1] Pacific railway system.
[2] W. H. Martin.
[3] Cabot Observatory.
[4] R. Rowland.
[5] Signal Service.
[6] S. H. Gerrish.
[7] Dr. E. K. Abbott.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
92	52	94	53	92	52	88	47	----	----	78	36	67	32	---
98	53	108	60	106	53	96	50	118	40	111	33	----	----	---
96	58	107	63	103	63	98	52	86	47	81	32	72	37	86
105	55	116	73	104	68	105	58	85	44	84	36	74	30	93
95	59	108	74	103	68	98	60	87	45	84	35	68	33	---
104	40	100	70	98	62	90	58	72	46	74	38	56	30	110
78	48	76	50	86	50	76	50	86	36	78	34	66	32	58
80	48	84	50	82	49	82	47	87	38	79	37	69	35	59
82	32	82	50	88	54	84	46	81	32	77	30	64	29	71
94	52	98	54	99	51	81	48	72	42	78	32	62	30	74
85	41	----	----	----	----	----	----	----	----	----	----	----	----	---
104	41	92	53	104	52	91	62	98	45	98	43	83	40	74
90	50	90	55	90	55	84	52	87	44	77	39	66	35	64
106	30	110	55	107	45	106	40	97	35	96	35	78	32	89
98	56	----	----	108	72	100	60	86	54	80	38	67	38	---
96	55	95	52	92	55	85	52	86	42	74	37	73	26	70
95	52	104	57	98	59	92	53	82	46	78	43	56	32	76
110	55	102	55	102	53	97	57	100	53	95	47	80	40	80
81	45	88	49	89	50	82	48	90	43	83	39	69	33	60
74	50	80	54	76	54	70	56	72	46	72	40	62	34	50
116	74	123	84	119	82	120	75	105	58	99	56	84	43	---
109	50	108	72	102	70	98	68	100	45	96	42	80	35	79
101	54	111	64	110	57	----	----	[i]97	[i]45	97	40	73	30	---
99	54	106	61	99	60	----	----	87	45	79	44	70	30	---
74	48	75	48	80	48	79	45	100	33	82	35	76	38	70
100	41	----	----	----	----	----	----	----	----	----	----	----	----	---
96	49	106	51	99	52	99	48	88	35	86	27	70	26	83
94	53	98	54	94	53	92	51	90	41	80	34	70	34	72
98	48	104	55	101	52	96	53	87	42	82	30	64	30	86
93	38	98	45	94	46	91	45	79	33	73	27	61	26	84
85	51	105	51	95	41	89	51	79	49	71	37	65	31	---
78	43	62	46	68	44	----	[a]47	----	43	----	43	[m]68	41	---
96	55	102	62	103	63	105	55	106	44	102	40	88	39	79
106	59	110	69	106	70	106	59	87	42	87	34	76	32	80
106	59	101	60	102	65	98	55	93	45	93	40	78	42	74
101	50	108	62	100	60	104	52	90	32	86	36	68	36	---
103	54	108	65	103	64	102	59	100	48	95	45	78	34	80
104	47	110	58	104	54	99	52	90	43	88	36	64	29	88
108	48	115	60	112	60	108	58	98	45	92	37	65	33	95
108	44	109	50	105	52	104	49	97	38	95	36	78	34	83
102	54	107	60	105	60	99	54	89	45	78	38	62	34	77
102	62	110	67	102	65	98	60	89	48	85	40	67	30	82
89	41	94	46	90	46	86	43	75	34	68	28	58	28	73
88	59	92	63	90	59	90	57	76	47	70	40	60	38	60
94	44	102	52	96	51	94	50	86	44	78	36	61	33	73
72	51	77	52	75	52	74	52	94	[g]44	94	[h]40	72	35	64
67	50	71	58	68	55	70	52	95	42	60	40	62	40	65
109	65	118	82	113	75	112	60	100	48	95	37	80	40	96
100	46	104	52	102	48	102	52	96	42	90	33	78	32	79
93	51	80	56	89	58	83	60	90	49	91	46	79	47	58
90	51	85	57	89	59	85	59	89	46	88	43	80	43	56
106	52	108	67	106	60	104	59	95	38	93	39	79	42	82

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
California—Continued.	°	°	°	°	°	°	°	°	°	°
San Francisco	59	36	64	36	70	41	81	46	85	47
San Francisco (presidio of)	60	30	69	28	72	35	81	38	80	43
San Gabriel	67	28	81	34	82	41	93	50	96	56
Sanger Junction	65	28	72	30	79	35	98	45	108	53
San José	60	30	68	32	72	37	82	43	93	46
San Luis Obispo	----	----	----	----	----	----	----	----	----	----
San Mateo	58	30	60	30	62	38	82	44	86	48
San Miguel	61	25	67	28	77	36	86	42	98	45
San Pedro	66	35	77	38	74	46	86	49	87	57
Santa Ana	68	32	80	36	80	40	94	46	90	56
Santa Barbara[1]	64	34	86	34	78	38	88	43	91	44
Santa Barbara[2]	62	28	69	40	78	46	86	54	87	55
Santa Clara	62	29	68	32	72	35	79	37	89	47
Santa Cruz[2]	65	32	72	34	70	38	84	44	88	49
Santa Cruz[3]	----	----	----	----	----	----	----	----	----	----
Santa Margarita	53	20	63	23	69	30	82	42	95	45
Santa Maria	62	29	76	30	76	34	83	37	86	41
Santa Monica	69	30	72	39	72	42	84	49	89	50
Santa Paula	64	34	69	36	76	49	----	----	94	54
Santa Rosa	60	27	66	28	68	34	78	40	95	43
Selma	54	27	64	29	74	38	86	46	100	56
Seven Palms	84	32	87	42	90	47	106	59	110	52
Shingle Springs	53	20	61	25	69	32	----	----	87	44
Sims	47	10	57	16	68	25	87	27	95	45
Sisson	----	----	47	2	55	17	71	17	89	36
Soledad	60	26	74	26	78	32	88	34	92	46
Sonoma	[c]68	[c]31	----	----	71	38	82	39	[d]94	[d]44
Soquel	68	30	72	29	78	34	86	40	84	48
South Side	60	24	78	32	78	34	80	38	96	35
South Vallejo	----	----	59	30	69	35	----	----	89	45
Spadra	71	30	87	32	84	38	92	48	88	52
Steeles	58	32	74	33	75	38	87	39	87	42
Stockton[2]	60	25	66	31	63	32	72	45	92	55
Suisun	58	30	70	32	74	40	82	46	102	48
Summit	34	5	35	25	38	27	41	31	----	----
Susanville	47	—8	54	—10	58	12	78	32	89	33
Tehachapi	52	15	58	14	63	25	81	36	85	30
Tehama	50	32	65	38	65	50	90	58	95	50
Templeton	59	25	71	26	76	33	86	38	98	49
Towles	47	14	56	16	60	28	74	34	87	32
Tracy	61	27	55	28	69	30	81	43	96	48
Traver	50	25	90?	30?	72	36	90	44	98	55
Tropico	64	28	82	36	82	37	91	40	99	50
Truckee[2]	36	—18	42	—22	46	—8	68	20	82	30
Tulare	64	31	67	33	78	36	96	45	104	56
Turlock	61	29	72	32	76	38	85	45	98	53
Upper Mattole	60	27	73	26	80	32	92	38	106	40
Vacaville[4]	59	30	70	31	72	38	83	46	94	48
Vacaville[2]	58	24	70	30	74	42	80	48	90	48
Valley Springs	61	28	74	33	75	38	85	43	95	45
Vina	60	28	63	32	73	38	84	50	98	46
Volcano Springs	83	29	89	38	98	39	106	50	116	68
Volta	62	28	68	30	74	38	88	52	99	54

[1] Hugh D. Vail. [2] Pacific railway system. [3] W. R. Springer. [4] G. O. Colburn.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
81	49	80	49	85	50	81	52	86	48	78	46	60	39	50
75	42	72	47	82	45	80	40	84	40	77	40	75	32	54
106	61	102	65	102	60	98	60	90	36	95	42	84	44	78
108	59	111	69	105	65	108	59	95	48	85	36	73	32	83
90	53	92	52	90	50	86	50	85	42	76	38	70	35	62
84	50	80	50	85	52	80	51	83	40	68	38	62	34	56
98	52	105	55	100	55	101	50	96	46	80	30			
96	58	99	63	100	63	94	62	95	50	95	46	80	48	65
104	58	100	64	106	60	90	64	95	54	85	46	86	36	74
93	45	84	53	98	52	85	52	96	44	90	40	76	44	64
94	60	88	60	95	61	83	60	89	49	80	42	69	38	67
87	42	88	46	87	47	86	44			76	36	62	33	
84	47	93	50	92	52	93	45	92	42	87	39	76	38	61
78	42	87	45	91	43	81	41	92	38	85	34	68	34	
98	46	104	48	96	46	96	44	86	30	80	25	70	23	84
[f]86	[f]42	[e]85	[e]45	[g]92	[g]46	82	48	92	33	86	36	76	33	63
89	60	80	66	81	64	83	60	86	48	82	40	78	42	59
99	60	92	61	95	60	85	58	88	48	82	44	80	45	65
86	42	100	51	88	48	87	45	86	40	75	33	62	31	73
100	60	107	65	100	61	97	61	89	42	86	35	61	34	80
115	65	122	85	118	73	115	39	98	40	94	40	82	43	90
99	55	105	60	102	60	97	56	85	48	82	35	70	33	
100	40	105	45	101	55	94	49	86	31	82	30	67	20	95
		93	57	94	47	82	48	73	27	69	24	58	20	
86	50	90	50	92	50	92	48	92	40	86	32	74	30	66
88	46	93	48	92	44	[i]87	[i]45	85	38	79	33	[h]62	[h]32	
84	48	86	50	82	50	80	48	88	40	80	34	70	38	59
78	46	89	50	88	48	80	48	80	50	68	40	62	32	
108	57	103	61	103	60	100	54	100	41	98	38	82	38	78
87	45	91	47	92	48	85	49	91	39	82	39	71	41	60
90	58	97	61			89	45			78	45			
99	50	103	56	99	57	100	54	94	44	89	38	80	32	73
49	32	80	45	82	50	79	43	72	27	62	25	49	17	
88	42	100	57	98	56	89	51	75	36	70	26	62	12	110
87	40	93	58	90	56	85	48	80	32	75	22	60	29	79
96	59	112	65	101	65	99	60	76	52	72	43	70	42	80
105	52	108	54	105	50	104	48	91	35	87	29	72	28	83
92	44	98	60	90	58	87	50	77	40	72	34	60	22	84
94	56	110	62	97	60	93	52			67	34	66	33	
102	60	104	64	93	58	93	58	82	48	75	33	64	33	79
104	58	99	67	98	60	94	52	100	46	98	38	88	40	76
86	35	92	44	88	40	82	42	78	28	68	16	42	0	114
105	58	111	66	104	62	105	58	93	45	98	41	77	32	80
98	58	105	68	106	62	98	55	85	45	78	35	66	32	77
94	40	95	50	95	48	100	45	92	34	88	32	78	32	74
97	55	107	60	99	59	100	56	89	46	83	38	68	32	77
97	57	107	58	99	62	95	53	89	46	83	38	68	22	83
96	50	102	65	96	60	94	55	86	45	80	40	65	34	74
104	58	108	70	106	70	99	58	89	46	82	38	63	30	80
118	75	126	80	120	80	122	65	110	45	97	35	84	38	97
102	54	106	66	105	63	101	60	86	51	80	33	[a]66	[a]33	78

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°
California—Continued.										
Walla Walla Creek	44	6	48	3	60.	15	76	23	87	32
Walnut Creek	59	27	70	29	72	34	84	40	101	43
Westley	58	28	65	32	72	34	83	45	98	53
Wheatland	57	27	66	28	69	36	83	39	102	45
Whittier	72	35	80	45	83	45	97	50	98	51
Williams	49	26	55	33	58	36	85	50	99	52
Willow[1]	58	26	69	26	74	28	90	30	99	43
Willow[2]	57	28	68	30	80	30	83	37	93	34
Winters	61	31	74	34	75	41	86	50	100	53
Woodland	50	28	64	30	70	35	76	42	87	44
Colorado:										
Agate	62	— 2	62	—16	72	8	74	18	88	22
Alma					46	—16	50	9	61	21
Apishapa	68	8	78	— 2	78	2	83	26	86	37
Bennett	72	—18	70	—10	85	— 7	85	29	89	34
Breckenridge	84	—26	73	—27	65	—31	65	0	74	11
Byers	73	1	74	— 8	78	0	82	18	84	40
Cañon City	69	— 1	79	— 9	74	4	80	16	88	38
Castle Rock					71	— 9	78	16	86	31
Cheyenne Wells	60	0	70	—10	75	4	84	24	90	35
Climax	40	—18	46	—26	38	—17	48	— 3	58	18
Colorado Springs	73	— 5	77	—12	70	— 2	74	16	85	30
Como (ranch near)	41	—11			49	— 7	54	5	66	20
Cumbres							n53	n15	62	23
Deer Trail	60	—10	64	— 8	72	— 6	78	20	84	38
Delta	56	— 4	64	— 8	67	5	79	21	89	32
Denver[3]	70	— 5	72	—11	69	— 4	78	18	88	32
Denver[4]	72	— 8	77	— 8	71	5	77	20	85	32
Durango[6]	70	—16	72	— 5	70	1	70	20		
First View	70	0	72	—10	75	8	84	24	90	34
Fort Collins	66	—13	68	—20	70	— 9	78	14	85	29
Fort Crawford	59	— 6	56	—11	51	0	66	21	79	30
Fort Lewis	51	—17	58	—16	55	—13	65	12	77	25
Fort Logan	73	— 7	77	—11	72	5	80	12	88	32
Fraser		—27		—24		—27		0		
Fruita	52	—17	56	—14	71	— 6	82	25	93	30
Georgetown	51	3	57	— 6	52	1	59	13	72	28
Greeley	65	1	66	—16	65	— 4	77	17	88	33
Greenhorn										
Gunnison	55	—39	50	—20	59	— 7	67	10	79	22
Hugo	70	10	70	0	70	0	78	28	90	35
Husted	65	— 7	77	—15	71	— 7	78	15	85	30
Idaho Springs	55	— 9	67	— 7					80	29
Julesburg							84	20	93	28
Kit Carson	68	— 0	65	— 6	71	20	78	29	85	50
Lamar	75	— 2	80	— 5	83	1	88	20	92	40
Las Animas	73	— 4	80	—11	79	1	84	21	87	40
Leadville	45	—10	50	—15	45	—11	53	8	63	20
LeRoy							82	19	93	30
Longmont	k63	—13k					80	15		
Magnolia	59	— 3	68	— 2	70	7	78	17	87	29
Monte Vista	55	—20	64	—10	64	— 8	71	5	85	27
Montrose	58	— 3	62	—13	64	— 2	74	23	83	31
Moraine	48	3	54	—12	53	5	62	13		

[1] David Bentley.
[2] Pacific Railway System.
[3] Rev. Wm. Forstall.
[4] Signal Service.
[6] T. J. Jackson.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
94	32	94	40	92	39	86	42	69	28	66	24	52	16	91
98	48	113	52	100	55	98	47	88	43	77	35	69	37	86
94	60	105	68	100	68	97	63	84	53	74	37	66	38	77
98	45	106	52	99	53	97	51	89	39	84	35	61	30	79
106	53	97	59	99	59	92	59	96	60	85	52	81	50	71
100	58	109	63	102	65	98	56	72	48	65	35	58	32	83
101	43	107	54	[m]101	[m]54			86	40	82	34	67	28	---
105	32	108	41	104	40	98	30	98	36	96	32	67	29	80
104	66	110	58	104	62	98	57	90	50	86	38	68	32	79
91	52	100	57	92	57	90	52	85	50	80	37	79	33	72
100	66	100	64					82	41	78	30	°63	°29	---
73	21	75	33	75	24	67	19	54	12	52	−6	46	−2	---
99	48	99	60	96	50	90	50	77	44	80	39			
108	45	108	68	104	58	100	40	85	30	82	12	87	24	126
83	12	87	26	80	26	83	11	85	−10	80	−20	72	−21	118
102	48	102	66	101	54	90	51	70	40	65	28	62	10	110
98	42	99	56	101	51	93	37			75	15	66	11	---
96	29	98	47	96	42	92	32	84	16	76	10	----	----	---
95	45	100	59											
65	18	68	40	66	35	62	7	55	5	48	−5	42	−4	94
92	38	94	50	96	44	86	32	74	22	74	15			---
73	24	77	37	76	30	69	25	57	8			43	0	---
70	33	76	43	71	41	71	22	56	7			47	−12	---
99	38	99	59			90	40	70	30	68	12	66	10	---
°96	°45	°100	°50	98	44	88	33	71	23	68	13	50	14	108
94	37	97	54	95	48	87	34	75	25	74	17	70	14	105
100	48	103	62	104	54	92	42			73	26	66	20	---
92	33	93	47	95	40	85	28	77	16	76	6	63	6	115
84	34	91	51	92	43	[g]77	[g]34							
81	24	88	40	89	43	84	30	70	21	67	9	50	−4	106
96	35	97	43	96	46	89	30	80	20	75	15	71	13	108
99	38	104	47	102	45	87	33	72	23	70	10	52	10	121
81	30	82	45	80	42	72	33	60	23	56	10	50	14	88
97	34													---
89	41	93	58	94	53	91	39	73	23	70	18	63	9	---
83	25					86	21							
95	45	100	59	95	51	88	40	71	28	70	18	60	11	100
95	34	100	46	100	42	89	28	78	15	75	11	66	4	115
84	36											58	7	---
102	39	102	52	102	36	95	31			77	6	72	4	---
95	56	98	65	98	62	74	47	70	38	68	38	70	24	104
103	47	106	56	103	52	99	36	84	20	80	11	69	7	111
101	41	103	56	103	50	96	24	80	20	79	11	78	8	114
71	20			74	31	70	25	55	10	54	3	53	3	---
100	43	107	54	101	47	92	36	80	25	72	13	63	13	---
98	37	102	52	[b]101	[b]44	92	32	87	31	80	15	[i]69	[i]12	---
105	45	105	39	94	50	94	48	79	30					
89	28	90	40	89	37	83	28	70	12	61	3	46	−6	100
87	37	96	52	93	44	84	35	71	24	65	11	51	12	109
78	28	88	38	84	32	75	26	62	18	59	4	55	1	---

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January. Max.	January. Min.	February. Max.	February. Min.	March. Max.	March. Min.	April. Max.	April. Min.	May. Max.	May. Min.
Colorado—Continued.	°	°	°	°	°	°	°	°	°	°
Pagosa Springs	----	----	----	----	----	----	----	----	----	----
Palmer Lake	58	— 4	73	—11	66	— 2	71	11	79	29
Pueblo	70	— 4	71	—14	76	— 2	79	20	89	36
River Bend	73	2	72	—13	88	21	83	28	92	35
Rocky Ford	----	—10	79	— 8	80	30	86	19	93	44
San Luis Experiment Station	52	—16	65	— 7	64	5	68	12	81	29
Sterling	----	----	----	----	----	----	----	----	----	----
Thon	62	— 4	70	—10	72	— 2	82	13	86	29
T. S. Ranch	54	— 4	58	— 5	68	— 3	77	22	85	32
Watkins	74	3	77	— 8	72	2	86	22	82	42
Westcliffe	56	—11	63	—15	59	—14	63	0	74	25
Connecticut:										
Canton	61	6	62	4	66	— 4	78	22	82	31
Colchester	62	10	66	8	67	2	78	24	79	35
Fort Trumbull	62	13	65	12	66	6	75	26	81	37
Hartford[1]	65	11	68	8	69	1	80	24	80	37
Mansfield	61	7	64	5	66	— 7	74	22	77	34
Meriden	60	8	----	— 2	----	— 2	----	26	----	----
Middletown	62	11	67	9	66	0	78	25	80	38
New Hartford[2]	54	3	54	— 3	55	— 9	70	19	76	33
New Haven	65	10	67	10	67	4	70	24	79	38
New London	62	14	65	14	64	7	70	28	77	42
Shelton	60	12	65	11	66	5	75	20	78	36
Southington	62	12	65	10	67	1	75	25	78	39
Thompson	61	9	54	4	----	----	72	22	74	35
Voluntown	60	6	62	9	[f]60	[f]1	77	21	78	34
Waterbury	61	9	65	8	65	0	79	24	79	36
Delaware:										
Kirkwood	----	18	----	24	----	10	----	38	----	44
District of Columbia:										
Kendall Green	----	----	69	22	73	14	----	----	----	----
Washington Barracks	73	15	73	20	73	15	84	24	86	40
Washington	76	19	73	24	77	13	82	25	86	42
Florida:										
Altamonte Springs	87	47	88	44	90	29	90	48	92	56
Alva	87	50	91	45	93	29	95	45	95	55
Archer	86	37	89	42	88	23	93	42	95	49
Fort Barrancas	79	36	79	36	82	25	84	44	87	50
Fort Meade	81	46	86	44	87	22	86	42	89	58
Homeland	83	50	88	49	91	25	91	49	93	57
Hypoluxo	----	----	----	59	----	37	----	58	----	68
Jacksonville	80	40	83	44	85	27	88	47	89	53
Jupiter	80	58	84	54	86	33	86	54	88	62
Key West	80	65	80	65	82	48	83	66	87	69
Lake City	89	37	87	42	88	23	90	----	92	41
Madison	75	40	80	47	80	28	86	55	83	53
Manatee	91	44	90	50	90	26	92	52	94	56
Matanzas	79	51	87	52	86	31	87	58	87	63
Merritts Island	81	56	86	55	88	34	90	58	89	63
Micco	84	[d]48	90	[a]50	95	[f]30	97	[g]50	96	[c]56
Ocala	81	45	86	50	87	30	[n]87	[n]62	----	----
Pensacola	79	36	76	37	80	25	81	52	83	55

[1] W. R. Matson

Rev. Wm. Goodwin

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
-----	-----	-----	-----	88	44	84	30	70	16	66	8	48	—15	---
98	41	100	54	100	48	92	36	79	22	78	15	70	9	114
103	43	112	60	90	52	96	42	-----	-----	88	20	66	14	---
102	39	104	55	103	47	96	31	93	22	80	13	70'	6	114
86	29	88	42	89	38	80	30	70	14	63	2	50	— 4	105
100	33	108	51	[d]102	[d]45	98	32	93	22	-----	-----	-----	-----	---
94	33	98	44	97	43	87	34	84	18	78	12	71	9	108
92	39	99	54	96	47	[d]85	[d]34	71	25	70	15	53	14	104
96	46	98	68	94	48	86	40	76	32	62	18	49	17	106
85	25	86	36	85	32	81	23	68	1	64	—12	57	— 7	101
88	43	92	44	89	46	83	30	71	28	64	12	48	1	96
85	42	91	45	84	48	80	30	75	29	61	14	53	2	89
92	47	95	51	89	43	85	40	77	33	68	6	52	5	90
92	45	93	46	90	52	82	34	72	31	64	15	46	0	93
83	40	89	42	84	45	80	33	74	32	64	13	48	— 2	96
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	11	-----	-----	---
88	46	94	46	88	48	81	35	73	30	66	15	52	0	94
88	46	98	44	86	47	81	28	70	25	56	10	38	— 2	107
88	48	91	49	85	47	80	36	73	33	69	17	51	5	87
87	51	88	53	83	51	78	40	74	36	65	18	52	8	81
87	45	93	49	-----	-----	80	35	72	30	65	15	-----	-----	---
88	49	92	46	86	51	80	33	71	30	60	15	44	— 5	91
82	47	88	47	83	47	78	36	70	31	63	12	46	2	---
86	38	92	44	85	[f]45	83	31	[i]72	[i]30	68	13	50	2	91
88	45	96	43	89	44	82	32	75	28	63	14	46	— 3	99
-----	64	-----	66	-----	60	92	50	82	38	62	26	-----	20	---
-----	-----	-----	-----	-----	-----	-----	-----	74	33	70	25	-----	-----	---
94	48	99	52	95	50	89	43	76	33	74	27	58	19	84
92	50	98	53	95	59	87	44	77	30	75	24	60	18	85
97	58	94	66	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
96	67	96	70	98	68	96	63	95	45	88	46	86	37	69
104	64	99	62	99	60	97	64	95	36	89	33	86	33	81
95	68	96	67	92	67	92	54	90	43	87	43	73	27	71
91	72	90	70	91	66	89	64	89	41	85	41	82	25	69
96	72	94	70	94	72	92	68	90	46	85	44	82	30	71
-----	74	-----	74	-----	74	-----	72	-----	53	-----	54	-----	48	---
97	66	96	66	94	64	92	65	90	43	84	39	80	30	70
95	71	94	70	90	69	89	69	89	48	83	53	82	44	62
89	70	89	69	89	70	89	70	88	64	83	65	80	56	41
99	64	97	65	97	61	-----	-----	-----	-----	-----	-----	-----	-----	---
95	73	94	71	88	71	87	68	83	48	80	42	-----	-----	---
95	65	95	71	94	69	94	65	93	45	90	40	-----	-----	---
95	70	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
96	70	91	70	92	70	90	69	88	50	83	52	78	42	62
96	[n]68	(*)	(*)	96	[n]70	(*)	(*)	93	[g]44	82	[d]44	82	[k]38	---
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	[h]81	[d]33	---
95	70	97	68	92	68	90	54	85	44	80	35	75	33	72

*Incomplete.

TABLES OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Florida—Continued.	°	°	°	°	°	°	°	°	°	°
Pine Level	----	58	----	55	----	36	----	58	----	63
St. Francis Barracks	79	43	81	45	87	28	j86	51	----	58
San Antonio	81	50	88	54	89	38	89	----	93	60
Tallahassee	79	34	81	39	82	23	84	48	88	54
Tampa	----	----	----	----	88	----	90	a52	90	58
Titusville	82	48	87	48	88	32	89	54	91	56
Villa City	83	52	86	52	88	35	90	60	90	64
Georgia;										
Albany	----	----	----	----	----	----	----	----	92	48
Allapaha	79	38	76	32	----	----	----	----	91	45
Andersonville	h98	h29	e99	c40	g99	g34	97	38	91	41
Athens[1]	72	27	76	32	77	19	83	40	87	43
Athens[2]	72	26	78	30	81	18	89	36	96	38
Atlanta	75	27	76	28	78	17	83	42	89	40
Augusta	80	29	84	36	84	23	89	39	92	45
Bainbridge	----	----	----	----	----	----	----	----	90	49
Blakely	----	----	----	----	----	----	----	----	----	----
Camak	----	----	----	----	----	----	----	----	90	40
Cartersville	----	----	----	----	----	----	----	----	90	38
Columbus	----	----	----	----	----	----	----	----	86	48
Diamond	----	25	----	28	----	15	----	35	80	40
Eastman	----	----	----	----	----	----	----	----	94	48
Forsyth	80	30	80	37	84	22	84	48	88	50
Fort Gaines	----	----	----	----	----	----	----	----	93	44
Fort McPherson	75	26	76	29	78	10	84	32	93	32
Gainesville	----	----	----	----	----	----	----	----	88	36
Gillsville	74	30	75	36	75	24	80	48	88	50
Griffin	----	----	----	----	----	----	----	----	90	42
Hephzibah	74	32	80	41	80	26	84	50	86	50
Louisville	----	----	85	38	82	22	90	39	91	44
Macon	----	----	----	----	----	----	----	----	91	44
Marietta	73	24	75	25	76	16	81	40	86	39
Milledgeville	77	28	79	36	82	21	94	40	87	43
Millen	82	26	85	37	87	21	84	34	94	44
Monticello	----	30	----	36	----	22	----	48	----	54
Newnan	----	----	----	----	----	----	----	----	88	40
Perry	----	----	----	38	----	22	----	46	----	54
Point Peter	----	26	----	31	----	21	----	38	----	42
Poulan	----	----	----	----	----	----	----	----	----	----
Quitman[3]	79	36	79	43	81	24	86	45	91	53
Quitman[2]	----	----	----	----	----	----	----	----	92	50
Savannah	78	32	80	38	81	26	88	46	89	51
Thomasville[4]	79	34	81	37	82	22	88	41	91	48
Thomasville[2]	----	----	----	----	----	----	----	----	91	48
Toccoa	----	----	----	----	----	----	----	----	90	38
Union Point	----	----	----	----	----	----	----	----	90	38
Washington	----	----	----	----	----	----	----	----	87	44
Way Cross	----	----	----	----	----	----	----	----	88	48
Waynesboro	----	----	----	----	----	----	----	----	92	44
West Point	----	----	----	----	----	----	----	----	88	50
Woolleys Ford	72	26	72	26	74	18	80	38	86	42
Idaho:										
American Falls	----	----	----	----	----	----	----	----	88	32
Boisé Barracks	51	—12	66	— 8	65	13	88	20	91	35
Boisé City	51	— 9	55	— 6	64	14	85	23	89	38

[1] Prof. L. H. Charbonnier. [2] Cotton belt. [3] J. L. Cutler. [4] R. Thomas, jr.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Ma.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
-----	66	-----	72	-----	72	-----	72	-----	56	-----	-----	-----	-----	---
[1]95	[1]69	91	69	90	70	88	68	87	45	81	42	79	36	69
95	66	92	70	93	70	92	68	90	50	85	49	80	30	65
93	70	92	68	90	63	89	64	87	40	82	36	75	25	70
94	65	92	65	93	67	92	66	90	46	86	43	81	31	---
95	66	92	69	94	70	88	67	90	47	83	49	82	38	63
97	70	96	72	98	68	94	69	91	42	88	48	78	36	63
[d]101	[d]64	100	63	94	62	94	60	88	40	80	32	-----	-----	---
98	59	98	58	95	58	92	60	88	34	82	35	-----	-----	---
102	59	101	55	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
96	65	96	63	90	59	88	52	82	34	75	29	70	26	77
105	60	101	61	90	56	88	52	82	32	75	27	70	23	87
98	62	96	61	90	59	91	52	85	32	82	30	71	26	81
102	66	99	64	96	59	94	56	90	36	80	32	71	28	79
99	64	98	66	90	64	90	62	86	40	82	32	-----	-----	---
-----	-----	98	68	94	65	92	60	92	44	84	32	* 80	27	---
100	64	100	61	94	58	91	53	85	34	77	30	-----	-----	---
97	60	98	65	94	56	94	54	84	30	76	25	-----	-----	---
96	68	95	67	88	64	88	60	80	40	76	35	-----	-----	---
-----	57	-----	65	-----	53	76	61	-----	32	-----	28	-----	23	---
104	64	104	60	100	58	96	56	94	36	84	32	-----	-----	---
101	68	100	69	92	66	94	56	90	40	85	36	75	32	79
102	62	98	64	94	58	92	56	88	38	82	30	-----	-----	---
101	62	99	62	93	57	92	50	-----	-----	82	30	70	24	---
92	58	92	59	88	54	88	51	80	30	76	24	-----	-----	---
96	69	94	68	88	64	-----	-----	-----	-----	79	29	-----	28	---
100	66	100	62	90	60	88	52	84	32	78	30	-----	-----	---
95	72	90	70	90	65	85	58	-----	-----	76	40	68	32	---
101	64	100	60	[e]100	[e]54	94	53	92	36	-----	-----	-----	-----	---
101	62	102	65	98	60	92	52	90	36	-----	-----	-----	-----	---
94	60	94	61	88	57	88	52	81	31	77	24	70	21	78
99	63	97	62	91	59	89	54	89	35	81	31	69	29	78
105	60	100	56	98	54	96	56	92	34	84	28	-----	-----	---
-----	70	-----	69	-----	64	-----	55	-----	38	-----	36	-----	31	---
96	56	97	55	95	40	90	50	82	30	78	28	-----	-----	---
-----	71	-----	71	-----	68	-----	62	-----	38	-----	40	-----	28	---
-----	66	-----	64	-----	60	-----	54	-----	36	-----	28	-----	28	---
-----	-----	-----	-----	-----	-----	96	60	90	36	85	30	78	22	---
-----	-----	-----	-----	-----	-----	-----	-----	87	42	82	38	75	29	---
102	64	102	62	98	62	94	64	88	40	84	34	-----	-----	---
98	65	94	67	94	63	88	58	89	41	79	36	77	31	72
-----	-----	94	68	94	61	91	62	90	39	-----	-----	-----	-----	---
100	65	97	68	-----	-----	91	62	90	39	84	35	-----	-----	---
97	60	94	62	92	54	92	52	78	32	-----	-----	-----	-----	---
100	62	100	60	94	54	92	52	86	32	80	26	-----	-----	---
98	62	98	60	92	56	88	53	84	32	76	30	-----	-----	---
96	66	96	70	94	60	91	60	88	42	84	36	-----	-----	---
-----	65	101	61	97	58	92	55	89	35	79	32	-----	-----	---
97	72	98	70	92	68	90	58	84	38	76	38	-----	-----	---
95	68	-----	-----	88	60	88	52	77	30	74	30	68	22	---
91	34	102	42	100	38	85	24	69	17	65	4	54	2	---
98	36	106	44	99	41	86	33	72	23	63	17	48	16	118
96	38	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Idaho—Continued.	°	°	°	°	°	°	°	°	°	°
Bonanza	.....	.....	.....	.....	.....	.....	°63	°10	74	17
Era	40	—12	44	—20	54	—10	76	12	75	28
Fort Sherman	45	—19	55	—27	53	8	82	21	85	38
Henry Lake	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Kootenai	40	—10	50	—26	53	7	80	22	86	45
Lewiston	58	— 9	58	— 9	65	31	89	24	93	39
Mullan	39	—15	45	—27	54	12	81	23	87	30
Payette	.....	.....	.....	.....	.....	.....	88	19	92	34
Soda Springs	41	—31	45	—29	47	—16	74	4	79	25
Illinois:										
Atwood	66	0	70	10	.....	.....	.....	.....	.....	.....
Aurora[1]	60	— 8	64	3	58	—10	78	17	88	29
Aurora[2]	61	— 7	63	3	58	— 6	79	20	91	34
Beason	63	— 2	68	8	60	2	82	26	89	30
Belvidere	46	— 8	60	2	55	—26	75	22	88	35
Cairo	73	17	75	18	74	11	80	36	88	42
Centralia	70	7	76	10	60	2	88	28	.....	.....
Charleston	.....	.....	70	11	63	5	82	28	90	33
Chicago	62	— 5	59	3	56	0	75	28	86	34
Cockrell	.....	.....	60	4	58	—21	80	32	89	36
Collinsville	70	6	76	6	65	6	88	28	88	36
Dwight	62	— 8	66	5	63	— 1	83	22	89	31
East Peoria	66	0	72	10	66	2	88	31	94	38
Flora	72	5	75	14	72	0	86	28	.....	.....
Fort Sheridan	58	— 7	56	— 2	57	— 2	75	28	90	33
Golconda	72	16	76	18	70	11	84	36	87	44
Greenville	73	3	74	8	69	5	86	27	91	34
Griggsville	62	— 2	65	4	65	0	85	30	88	38
Hennepin	63	— 5	66	6	49	— 7	.....	21	87	28
Jordans Grove	74	9	78	8	68	2	88	26	90	36
Lacon	59	— 3	67	7	64	— 3	81	28	89	38
Lake Forest	60	— 7	60	3	54	— 5	79	19	94	33
Lanark	48	—11	57	2	54	—11	.....	.....	86	31
Louisville	72	4	73	14	65	6	84	28	90	35
Martinsville	70	7	70	16	65	8	80	32	88	32
Mascontah	74	4	73	8	70	2	92	22	89	34
Mattoon	.....	.....	.....	.....	.....	.....	80	.....	88	.....
McLeansboro	74	8	75	14	70	4	84	30	96	32
Olney[3]	.....	.....	72	14	70	9	81	35	92	42
Olney[4]	70	9	72	16	68	10	82	34	91	40
Oswego	56	— 6	64	2	58	—10	80	20	89	36
Ottawa	59	— 2	65	9	64	— 1	82	19	90	32
Palestine	71	9	72	16	65	6	82	29	89	34
Pana	70	6	72	15	66	2	86	36	91	44
Peoria[4]	66	— 2	68	7	65	— 1	84	31	93	33
Philo	67	— 4	70	8	63	3	83	26	88	32
Pontiac	64	— 4	66	8	62	— 2	86	24	94	32
Riley (Marengo)	53	—10	59	0	53	—13	76	20	84	29
Rockford	56	—10	59	1	54	—18	76	20	88	31
Rock Island Arsenal	57	— 7	63	3	62	—11	83	18	90	24
Rushville	63	— 2	70	2	66	— 2	86	26	94	32
Sandwich	56	2	65	5	.....	.....	.....	.....	.....	.....
South Evanston	.....	.....	.....	.....	55	— 2	76	20	°90	°32
Springfield	68	— 2	71	4	64	2	85	26	89	35

[1] W. Holden. [2] Dr. M. M. Robins. [3] Victor E. Phillips. [4] C. H. Fahs.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
80	24	90	28	84	24	81	11	- - -	- - -	55	0	46	− 9	- - -
84	24	92	37	88	34	80	24	67	13	61	7	50	2	112
92	40	98	44	92	42	84	30	78	27	70	25	58	25	125
72	38	- - -	- - -	91	30	81	16	63	10	62	1	44	− 8	- - -
92	47	100	51	92	45	83	39	69	25	61	19	55	20	126
101	46	104	50	95	49	87	37	75	30	62	21	55	26	113
88	35	102	38	95	38	88	30	70	23	67	19	50	22	129
99	31	113	42	106	45	90	31	73	15	68	10	54	15	- - -
88	28	95	27	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
- - -	- - -	106	42	104	42	- - -	- - -	88	20	- - -	- - -	- - -	- - -	- - -
96	40	95	43	98	40	88	32	76	25	66	19	51	− 2	108
99	42	- - -	- - -	90	44	90	36	77	27	69	23	55	2	- - -
98	48	99	46	97	44	90	33	87	23	68	24	58	9	101
95	51	94	46	94	45	90	32	75	26	64	20	52	− 2	121
96	62	95	59	91	56	87	45	84	32	72	31	63	20	85
- - -	- - -	102	65	100	52	- - -	- - -	86	26	70	24	60	2	- - -
98	53	98	46	93	43	92	36	89	28	72	25	56	6	- - -
92	52	93	56	96	51	88	39	73	28	67	27	53	8	101
99	59	98	59	102	47	90	36	77	29	62	20	48	0	- - -
96	53	98	50	98	50	94	38	88	25	76	30	62	10	92
101	44	102	43	101	43	92	32	- - -	- - -	- - -	- - -	- - -	- - -	- - -
104	62	103	58	104	54	96	47	94	26	74	27	62	11	104
98	53	102	46	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
96	41	94	53	d98	49	k79	25	73	12	64	23	51	0	105
96	63	97	65	96	60	91	46	84	31	72	30	62	18	86
100	49	103	46	101	45	95	35	90	22	75	25	59	7	100
90	56	93	57	92	56	89	40	86	25	75	25	56	18	95
97	42	100	42	102	42	92	31	80	25	70	20	54	7	109
96	54	98	48	94	50	93	39	87	26	71	26	60	3	96
98	57	90	56	98	49	91	36	81	26	70	22	54	10	101
94	44	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
94	52	93	54	93	48	85	36	72	25	68	22	52	0	- - -
96	54	100	50	97	50	89	40	86	28	70	24	57	5	96
98	60	94	68	- - -	- - -	90	40	81	31	- - -	25	57	6	- - -
99	56	103	50	99	52	90	40	- - -	- - -	76	23	60	6	- - -
101	58	96	- - -	- - -	- - -	- - -	- - -	84	34	77	27	55	15	- - -
102	56	106	50	101	46	93	40	89	26	- - -	- - -	58	18	- - -
98	56	98	54	96	50	88	44	86	33	72	29	59	12	- - -
98	58	99	60	98	56	90	43	85	33	70	27	56	8	91
98	50	99	45	100	44	90	34	76	24	65	22	52	4	110
98	44	102	48	101	44	d90	34	80	28	70	23	56	10	104
96	54	97	50	97	46	91	37	86	30	74	23	56	7	90
96	63	100	62	98	57	92	45	87	30	72	32	61	15	98
100	57	102	60	102	52	93	40	86	26	74	26	60	16	104
100	52	97	45	98	42	90	30	86	26	69	19	56	5	104
104	44	100	44	104	46	94	30	84	24	72	20	56	6	108
91	44	92	49	96	46	88	35	74	24	62	20	51	− 1	109
95	46	95	43	97	43	88	32	73	26	59	21	51	0	115
96	40	100	38	102	34	90	42	81	25	70	22	58	4	113
100	54	106	47	98	49	93	38	87	23	78	26	62	14	108
93	- - -	96	- - -	96	- - -	85	35	74	20	70	22	60	4	- - -
96	42	96	46	99	49	89	36	73	32	67	24	53	2	- - -
97	50	100	51	97	48	91	36	88	23	74	26	60	14	102

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Illinois—Continued.	°	°	°	°	°	°	°	°	°	°
Sycamore	54	—8	61	2	57	—11	76	15	87	35
Watseka	64	—2	66	7	62	2	80	23	91	32
White Hall	66	4	74	4	68	2	84	28	90	36
Winnebago	50	—10	63	4	58	—15	80	32	92	34
Indiana:										
Angola	64	6	62	13	56	—2	78	24	91	32
Butlerville	----	7	68	17	----	1	77	33	84	44
Cannelton	70	12	72	17	66	6	81	31	89	34
Columbia City	63	3	63	7	57	0	76	24	86	32
Columbus	68	10	70	19	67	2	78	32	90	40
Connersville	68	4	69	16	63	4	78	31	85	41
Crandall	----	----	----	----	----	----	----	----	96	31
De Gonia Springs	70	16	70	19	63	5	78	35	83	40
Delphi	63	—1	65	8	59	3	75	20	86	31
Farmland	68	4	66	14	62	6	78	30	86	39
Franklin	70	7	69	16	67	5	77	32	88	40
Huntingburg	70	18	78	19	66	11	81	31	93	47
Indianapolis	70	4	69	14	64	8	78	29	87	39
Jeffersonville	70	14	71	21	67	2	81	33	88	39
Laconia	68	14	76	20	70	2	83	32	92	42
La Fayette	70	—3	69	6	63	4	78	25	87	34
Logansport[1]	68	1	64	10	56	4	78	24	87	31
Marengo	69	18	73	23	72	0	85	41	92	45
Marion	66	1	67	9	59	7	78	28	86	30
Mauzy	65	1	66	12	62	—1	74	26	90	33
Mt. Vernon[2]	71	13	71	18	65	7	79	32	90	39
Muncie	68	8	68	18	74	10	78	34	96	41
New Providence	72	11	70	16	68	—6	77	29	85	33
Point Isabel	68	0	63	8	70	1	82	22	86	29
Princeton	69	10	72	14	66	7	79	30	91	40
Richmond	68	4	63	14	62	4	74	27	85	33
Rockville	----	----	----	----	62	7	82	31	93	35
Seymour	69	10	70	18	67	4	82	31	87	40
Shelbyville	68	12	68	18	62	9	78	34	88	43
Spiceland	68	5	69	14	63	4	77	28	89	36
Sunman	67	2	72	14	66	2	77	20	88	34
Terre Haute	----	----	----	----	----	----	----	----	----	----
Valparaiso	----	----	----	----	----	----	----	----	80	31
Vevay	70	10	71	20	68	2	82	26	91	36
Worthington	71	4	68	15	64	5	82	31	84	35
Indian Territory:										
Caddo Creek	72	10	81	4	86	20	94	38	92	51
Fort Gibson	78	13	77	7	k80	k7	86	38	89	41
Fort Reno[3]	80	5	83	0	84	14	90	32	89	35
Fort Reno[4]	80	10	83	1	84	14	----	----	----	----
Fort Sill[3]	88	10	81	5	----	14	90	34	90	42
Fort Sill[4]	70	12	82	6	89	14	91	34	88	42
Fort Supply[3]	82	4	76	—1	83	13	----	31	90	32
Fort Supply[4]	81	5	78	2	84	15	90	31	89	34
Guthrie	74	11	80	6	80	18	92	36	90	46
Healdton	76	28	74	10	79	16	83	36	86	52
Iowa:										
Afton	----	----	----	----	----	----	----	----	----	----
Alta	46	—20	54	—18	62	—8	80	21	88	33

[1] D. E. Prior. [2] J. M. Lockwood. [3] U. S. post hospital. [4] Signal Service.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
95	50	97	44	98	43	88	30	74	24	63	18	51	— 2	109
90	42	99	45	101	41	91	32	80	29	68	23	----	----	---
96	57	100	56	96	48	94	38	90	26	72	26	60	6	98
99	54	98	----	100	51	93	40	78	28	62	20	50	0	115
98	60	103	58	100	47	90	35	76	33	66	23	46	13	105
98	60	88	65	86	54	87	43	78	30	70	28	54	10	---
100	55	----	----	96	46	91	35	85	38	75	28	56	18	---
93	58	94	52	95	43	86	35	78	30	65	20	46	14	95
96	56	97	54	95	49	88	41	82	32	72	26	56	6	95
93	58	95	65	95	53	86	42	80	32	67	24	53	10	91
----	----	100	65	97	50	91	37	----	----	71	45	----	----	---
93	60	93	57	91	51	87	43	82	32	72	28	56	18	88
96	40	94	44	95	40	88	33	77	26	63	19	52	8	97
96	56	96	58	96	50	88	39	82	30	68	26	50	10	92
97	57	97	59	98	50	89	41	83	32	71	24	54	9	93
104	68	----	----	100	60	92	44	85	34	71	24	----	----	---
97	50	97	52	96	46	89	40	84	33	68	27	52	12	93
96	59	96	54	94	51	89	43	84	34	71	27	59	18	94
100	----	99	72	----	----	----	----	----	----		----	----	----	---
98	44	96	51	97	43	89	36	82	28	67	21	53	6	101
96	49	99	43	98	53	87	42	75	30	66	24	52	14	98
98	62	96	60	96	53	89	42	85	35	71	27	----	----	---
97	57	96	55	96	52	----		----	----		----	----	----	---
98	45	99	45	98	40	----	40	81	27	67	19	48	2	100
98	60	99	55	----	----	----	----	84	32	68	30	58	16	---
104	61	97	55	95	56	88	42	84	34	66	27	52	11	96
----	----	----	----	----	----	----	----	----	----	----	----	----	----	---
95	35	95	41	92	35	85	31	78	20	63	14	45	2	95
101	60	100	64	97	54	92	42	85	30	72	28	55	3	98
96	50	96	49	96	45	88	38	66	22	----	----	----	----	---
97	50	93	50	90	45	86	36	82	30	72	24	55	7	---
95	52	95	51	92	50	85	38	85	30	70	25	54	12	91
96	64	----	----	----	----	----	----	[d]77	35	71	28	47	14	---
----	----	----	----	----	----	----	----	----	----	----	----	----	----	---
97	48	92	53	92	44	86	39	81	26	----	----	----	----	---
102	53	101	52	94	47	88	38	----	----	68	27	----	----	---
96	46	----	----	----	----	98	50	73	28	67	27	53	10	---
96	55	96	55	95	44	91	38	85	32	72	20	58	10	94
96	59	94	55	94	47	87	42	84	32	70	24	56	4	92
98	61	101	66	----	----	----	----	----	----	----	----	----	----	---
98	57	104	62	102	56	90	48	----	----	----	----	----	----	---
101	49	105	62	104	58	93	36	84	33	83	22	76	6	105
----	----	----	----	----	----	----	----	----	----	----	----	71	[j]24	---
102	53	106	64	103	61	94	42	85	36	86	27	72	15	101
100	54	103	62	103	61	94	42	85	36	86	27	72	15	97
98	45	105	59	105	53	94	32	88	31	83	20	73	6	106
99	48	----	----	----	----	----	----	----	----	----	----	----	----	---
102	64	106	70	108	66	92	46	88	40	80	27	70	8	102
98	55	100	65	[d]100	[d]62	92	42	83	39	84	35	70	25	90
----	----	103	61	93	54	86	38	76	22	----	----	----	----	---
93	52	99	56	95	42	90	29	72	20	61	18	62	—1	119

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°
Iowa—Continued.										
Amana	50	—18	58	— 2	62	—14	78	24	90	30
Ames	47	—20	56	— 8	66	—14	80	20	88	35
Atlantic							[k]82	[k]36	91	33
Bancroft	47	—20	52	—19	57	—19	84	12	88	32
Belle Plaine	48	—16	58	— 6	63	—12	80	26	90	32
Blakeville	49	—18	57	— 6	64	—14	82	23	96	32
Carroll	48	—20	57	—14	67	—12	82	16	86	28
Carson	48	0	59	0	62	0	84	34	86	35
Cedar Rapids	53	—13	60	0	62	—10	78	24	89	30
Clarinda	54	—17	62	— 8	75	— 8	[l]86	23	88	34
Clinton	55	—10	63	3	61	—19	81	23	92	26
Cresco	43	—21	51	—12	55	—18	78	18	85	30
Davenport	54	— 7	63	4	61	— 8	81	27	90	33
Des Moines [1]	51	—21	60	— 5	67	— 9	82	24	90	32
Des Moines [2]	50	—18	59	— 5	66	— 8	83	25	89	32
Dubuque	52	—16	58	— 1	59	—12	78	26	90	30
Eagle Grove	48	—25	53	—14	57	—22	78	11	90	32
Elkader	44	—26	52	— 6	56	—24	76	26		
Fayette	48	—27	57	— 5	67	—24	74	16	88	26
Fort Madison (near)	55	— 5	65	2	58	— 5	84	33	93	39
Glenwood[1]	61	—20	66	—15	74	—12	88	22	94	32
Greenfield										
Grinnell	49	—13	56	— 6	64	— 9	78	31	88	35
Hampton	44	—21	54	—11	62	—14	75	13	87	28
Humboldt	46	—22	54	—11	64	—20	82	10	88	29
Independence	45	—19	[d]53	—[d]4			76	30	85	35
Indianola									88	30
Iowa City	52	—10	59	4	56	— 6	72	28	81	31
Irwin									88	30
Keokuk	64	— 5	67	— 1	67	— 6	84	27	90	35
Larrabee	47	—22	52	—24	57	—21	80	16		
Logan	54	—20	64	—13	67	—13	83	19	88	32
McCausland	52	— 6	65	8	61	—10	79	35	90	41
Manson	46	—22	62	—18	54	— 8	80	28	88	30
Maquoketa	48[c]	— 8	62	2	62	—15	80	31	[e]88	[e]32
Monticello	47	—14	58	— 1	59	—16	80	20	90	29
Mount Pleasant	56	— 6	68	5	62	— 5	80	36	85	38
Mount Vernon	52	—15			63	—13	86	27	87	34
Muscatine	57	— 7	63	3	60	—15	82	25	88	27
Osage								[m]33		32
Oskaloosa	56	—17	63	1	66	—10	82	26	92	36
Panama										
Sac City	42	—22	55	—15	51	—10	82	15	86	32
Sioux City	52	—20	62	—18	58	— 7	88	13	88	30
Storm Lake	44	—12	54	—19	54	—12	74	20	86	32
Vinton	45	—18	54	— 3	61	—11	80	21	88	34
Washington	56	— 8	63	2	62	— 8	80	26	94	33
Webster City	45	—20	54	—10	67	—17	82	21	86	32
Wesley	44	—21	51	—13	58	—20	81	2	86	27
West Bend	43	—20	51	—12	58	—20	82	10	88	33
Kansas:										
Abilene	66	—12	66	— 2	72	15	84	24	84	35
Allison	63	—14	70	—11	82	6	89	27	92	40
Alton										

[1] Adolphus Voegeli. [2] Signal service.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
97	48	100	47	100	45	89	30	80	22	60	20	54	0	118
94	55	100	58	100	52	89	35	76	22	...	...	...	...	...
100	39	108	37	99	36	94	23	79	17	69	17	68	—3	...
97	49	98	53	91	46	88	32	74	19	60	9	g45	—10g	117
97	56	100	56	102	46	88	32	81	22	60	16	58	2	114
100	51	101	60	102	50	92	36	84	24	78	16	...	...	...
95	48	99	50	94	40	92	27	78	19	65	10	67	—2	119
98	55	106	52	100	45	96	34	79	22	66	19	56	4	106
96	49	98	56	96	47	87	32	78	20	60	19	55	0	111
98	52	105	57	100	51	90	34	76	26	67	22	63	5	122
96	47	99	47	101	45	92	33	81	23	66	19	55	—1	120
91	45	96	47	94	42	86	28	71	16	59	8	47	—10	118
98	52	97	55	97	49	90	37	81	25	69	26	57	6	107
98	49	103	55	101	45	89	30	...	...	...	...	...	...	...
96	49	101	55	97	48	89	33	79	22	67	19	66	3	119
96	52	98	54	99	48	90	32	75	26	60	24	53	1	114
98	53	98	56	98	45	88	32	78	17	63	10	a66	—14a	123
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
94	47	98	47	98	37	88	25	78	17	60	10	...	...	...
98	60	100	64	99	55	90	39	84	30	68	23	55	13	105
106	50	110	54	d102	d48	96	32	d77	d26	72	18	72	4	126
...	...	...	...	...	...	89	30	79	20	64	18	63	2	...
94	f55	98	52	98	46	88	34	77	22	59	20	54	0	111
94	47	97	47	97	40	87	28	77	17	60	11	52	—8	118
94	48	96	47	96	38	87	30	77	18	60	12	54	—15	118
92	58	92	59	91	53	82	41	76	26	56	20	51	—2	...
96	48	...	...	...	...	...	...	79	20	64	19	64	—1	...
88	50	m93	m57	88	50	82	37	75	28	65	25	58	6	103
94	48	100	50	94	d36	...	...	...	...	...	...	...	...	...
98	53	104	54	98	49	92	36	86	22	77	26	57	13	110
...	...	99	...	...	...	...	...	...	...	...	...	...	...	...
96	50	100	50	93	43	94	31	82	27	68	18	68	2	120
96	60	90	60	100	52	88	33	77	24	60	21	51	9	110
98	54	100	58	98	40	88	30	74	24	54	12	58	—8	122
97	55	99	57	98	48	91	33	78	20	62	21	53	5	114
97	53	98	50	96	44	87	31	80	18	62	18	51	0	114
93	60	96	62	92	57	85	42	81	26	64	28	54	12	102
94	53	94	56	96	51	88	33	81	23	60	22	57	5	...
96	51	100	51	98	54	88	32	75	23	66	22	59	5	115
...	53	...	60	...	47	...	32	...	17	...	11	...	—7	...
96	57	100	57	98	53	87	38	82	25	66	27	58	10	117
...	...	...	...	...	...	86	36	77	26	64	15	65	1	...
93	47	98	50	90	35	80	28	80	26	54	9	56	—4	120
96	50	104	50	93	43	89	34	72	24	74	15	68	—3	124
94	48	99	60	92	50	86	38	73	22	58	16	55	—4	118
93	54	98	54	98	48	89	29	79	21	60	15	54	—4	116
102	54	102	54	102	48	90	34	84	23	70	24	54	7	110
96	52	100	52	99	45	88	30	78	16	62	10	52	—14	120
92	44	95	45	93	34	...	...	...	...	...	...	...	...	...
91	52	95	57	92	46	87	34	73	18	64	11	51	—18	115
96	58	104	62	99	58	90	42	86	30	70	18	69	6	116
102	48	105	59	108	52	98	32	84	27	73	17	65	4	116
103	46	113	53	110	52	100	32	86	25	72	13	73	7	...

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Kansas—Continued.	°	°	°	°	°	°	°	°	°	°
Buffalo Park	55	— 5	68	—10	72	15	88	29	88	45
Bunker Hill	64	— 3	72	— 6	80	0	90	28	----	----
Burr Oak	61	—15	69	—10	70	8	95	24	94	30
Carneiro	65	— 5	74	— 2	80	10	85	30	----	----
Cawker City	54	—11	58	— 6	----	----	86	32	96	45
Collyer	63	— 6	62	— 8	72	15	90	26	96	40
Concordia[1]	54	—22	70	— 8	70	12	92	25	86	26
Concordia[2]	58	—14	71	— 7	70	9	92	24	87	31
Conway	56	—10	70	— 6	70	12	88	25	88	32
Cunningham	69	0	75	— 8	79	7	95	29	91	32
Dodge City	72	— 3	78	— 6	77	11	89	25	94	36
Elco	----	----	----	----	78	10	90	30	92	34
Elk Falls	76	5	----	----	----	----	g85	g38	85	38
Ellis[3]	65	—13	74	— 8	75	9	88	25	91	27
Ellis[4]	62	— 4	75	— 6	----	----	91	24	96	46
Ellsworth	60	—10	68	— 2	73	18	90	35	----	----
Emporia	68	— 3	71	1	72	10	84	h37	87	35
Englewood	79	4	72	0	83	18	88	30	88	44
Eureka Ranch	66	—11	----	----	85	7	92	26	106	29
Fort Leavenworth[6]	65	— 9	70	— 4	76	3	90	27	86	34
Fort Leavenworth[5]	62	— 8	66	— 2	72	— 3	84	29	82	36
Fort Riley	61	—12	65	— 5	76	— 3	90	31	98	32
Fremont	72	—21	82	—11	79	— 8	90	24	97	28
Gibson	----	----	----	----	76	5	90	22	98	26
Globe	----	— 7	69	— 4	74	8	87	32	87	41
Gove City	78	— 3	92	8	81	11	105	25	103	36
Grainfield	59	— 6	70	— 9	70	10	82	27	86	42
Greenridge	----	----	72	— 7	76	11	91	25	89	30
Grenola	74	2	76	— 1	82	6	91	35	96	42
Grinnell	62	— 4	78	— 9	72	25	90	24	98	48
Halstead	61	0	68	— 3	76	12	86	29	86	32
Havensville	56	2	70	—10	74	— 4	97	28	96	38
Hays City	62	— 6	72	— 4	80	10	90	30	----	----
Horton	61	—15	66	—10	75	0	97	30	90	32
Hoxie	----	----	----	----	80	2	88	20	----	----
Independence	74	2	75	0	79	9	88	35	90	35
Kansas City	67	— 5	72	— 2	76	1	89	29	89	36
Kellogg	77	— 1	79	— 4	85	5	92	33	94	32
La Crosse								----	91	39
La Harpe	----	6	----	8	----	19	----	34	----	39
Lakin	75	0	78	— 6	81	12	96	26	89	30
Lawrence	63	— 5	65	— 2	76	4	89	29	89	39
Leavenworth	67	— 6	70	— 3	76	0	90	29	88	36
Lebo	70	— 5	76	— 1	78	5	90	27	91	33
Leoti	70	— 8	80	—10	80	5	89	20	95	34
Lincoln	58	— 5	70	— 3	80	18	90	30	90	38
Lisbon	64	— 2	80	— 3	80	15	90	30	100	44
Luray	64	—10	72	— 6	74	10	90	30	91	36
McAllaster	66	—11	68	—13	80	5	90	24	91	41
Macksville	65	— 7	72	— 7	72	11	91	25	87	30
Manhattan[6]	62	—19	70	— 5	77	2	93	26	92	30
Manhattan[7]	56	—18	63	— 2	70	12	94	29	92	34
Mankato	59	—11	70	—10	65	4	95	25	90	35

[1] H. A. Williams.
[2] Signal Service.
[3] F. L. Williams.
[4] Agent Union Pacific Railroad.
[5] U. S. post surgeon.
[6] C. M. Breese.
[7] C. P. Blachley.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
108	58	110	60	107	61	73		82		73	20	66	8	120
102	48	106	54	103	50	90	27	86	26	72	20	70	5	121
101	62	112	68	100	60	90	30	88	33	72	22	70	10	
120	56	110	58	102	62	101		84		72	28	60	9	128
98	42	105	50	101	46	97	30	81	22	72	16			
97	49	103	56	101	49	97	33	86	27	75	21	71	8	117
		106	62			90	36							
96	46	106	56	108	56	104	32	89	28	78	17	70	7	116
102	44	104	60	102	54	94	36	86	28	77	18	70	10	110
101	54	104	57	106	58	92	36	88	31	73	23	74	10	
98	48	100	62	102	62	96	38	83	32	80	28	70	8	
		109	73	97	40									
108	60			109	60			80	25	76	20	70	12	
		98	57	99	57	88	41	80	30	70	25	68	10	
99	56	107	68	101	60	95	35	88	32	77	22	68	17	107
116	46	117	58	112	52	104	31	85	22	80	18	71	4	
97	52	104		100	55	87	36	79	27	m74	23	70	9	113
94	53	98	59	95	55	84	38	76	28	69	22	65	10	106
101	39	103	60	103	56	92	34	85	28	72	23	66	5	115
110	41	109	54	108	41	101	29	87	21	77	15	73	4	131
108	42	118	56	111	50	98	32							
96	63	102	67	99	58	99	37	80	30	68	22	65	8	109
111	53	120	62	119	54	105	40	85	27	88	23	79	7	123
106	60	108	72	104	62	96		84	32	72	25	65	8	117
104	62	105	70	109	62	95	40	88	32	76	27	68	2	110
112	62	116	70	108	06	96		84	30	76	26	70	10	125
96	56	102	55	103	56	92	32	83	31	68	19	68	5	106
110	52	111	60	101	54	93	29	80	19	70	16	63	2	121
102	59	107	60	104	50	93	37	86	26	68	21	67	8	122
106	33							85	30	74	29	78	10	
102	56	104	60	105	59	94	36	88	30	76	26	66	6	105
102	50	107	60	102	54	97	35	83	25	75	24	67	10	112
106	52	113	57	115	57	101	32	89	30	76	21	66	7	119
103	47					98	38	82	16	74	24	69	9	
	46		72		60		49		38		28		16	
104	40	107	45	106	40	103	20	86	15	80	9	68	—3	113
96	52	100	65	99	55	90	37	80	28	68	24	67	15	105
97	51	102	58	98	55	88	37	79	29	74	24	70	12	108
102	50	104	52	104	54	92	33	88	26	75	21	76	7	109
104	39	107	52					83	21	74	17	70	7	
98	58	104	70	103	54	98	40	84	30	84	22	66	10	109
106	60													
105	56	114	68	104	50	86	20	84	22					
105	50	100	68	98	55			82	28		22	70	5	
96	43	106	53	104	56	99	30	81	21	74	15			
103	44	107	54	102	50	95	30	86	23	76	16	72	3	126
106	54	108	63	104	55	98	32	80	26	73	18	64	6	126
96	53			105	49	90	30					71	6	

TABLE OF MAXIMUM AND MINIMUM TEMPERATRES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Kansas—Continued.	°	°	°	°	°	°	°	°	°	°
Marmaton	72	0	76	−1	77	2	84	32	----	----
Minneapolis	58	−11	62	−4	74	12	86	28	86	30
Monument	64	−12	76	−12	81	1	84	22	95	39
Morse	70	−10	60	−2	70	−4	85	30	85	33
Norton	----	----	----	----	----	----	----	----	98	41
Oakley	70	−10	76	−8	82	0	92	28	100	48
Offerle	70	−1	73	−5	77	11	91	27	93	44
Ogallah	65	−5	65	−6	----	----	88	27	91	45
Oswego	74	4	74	0	78	6	86	35	89	34
Page City	----	----	----	----	----	----	----	----	----	----
Quenemo	70	−4	75	3	77	4	90	29	92	33
Quinter	64	−8	79	−12	79	6	88	30	94	38
Richfield	75	3	89	−2	83	16	90	26	----	----
Rome	72	3	73	−1	78	13	88	34	91	34
Salina	54	−6	58	−6	68	12	84	30	86	42
Sedan	75	4	76	0	80	12	89	36	91	40
Seneca	59	−22	68	−10	72	−2	94	26	----	----
Sharon Springs	72	2	----	----	80	14	86	28	88	44
Shields	63	−4	76	−12	78	12	90	28	95	32
Topeka	64	−10	73	−5	75	1	90	24	88	32
Tribune	72	4	78	−9	80	−5	86	22	92	34
Wa Keeney	60	−2	76	−4	75	18	84	30	94	38
Wakefield	62	−8	70	−4	----	----	----	----	----	----
Walker	66	−9	74	−10	74	10	92	27	----	----
Wallace (2)[1]	----	----	----	----	----	----	----	----	----	----
Wellington	75	2	78	0	83	14	----	----	95	35
Weskan	70	−2	79	−5	85	23	92	32	95	40
Wichita	70	0	73	0	79	5	91	32	90	36
Wilson	62	−5	64	−4	74	18	88	30	----	----
Winona	70	0	76	−11	80	8	88	28	92	40
Yates Center	73	−1	77	−1	75	5	90	31	----	----
Kentucky:										
Bowling Green	73	16	76	20	74	12	92	33	89	35
Caddo	----	----	68	16	60	4	----	----	87	35
Canton	70	18	72	22	78	15	82	34	90	40
Central City	----	----	----	----	----	----	----	----	----	----
Earlington	72	17	76	16	74	10	83	35	87	37
Edmonton	----	----	----	----	----	----	----	----	----	----
Frankfort[2]	72	15	74	19	69	6	85	28	90	36
Franklin	71	21	74	21	70	17	84	37	88	43
Harrodsburg	----	----	----	----	----	----	----	----	91	32
Lexington	71	14	70	19	70	6	80	31	86	39
Louisville	72	14	73	22	67	13	82	34	88	39
Millersburg	67	20	70	25	66	14	76	37	83	45
Mount Sterling	66	15	70	23	64	7	81	32	85	38
Murray	71	15	74	19	73	9	----	----	----	----
Newport Barracks	71	11	70	18	68	7	82	29	89	35
Owenton	64	10	[d]69	[d]18	[e]67	[e]4	[d]72	[d]30	88	38
Pellville	77	19	87	19	74	4	86	32	91	37
Princeton	74	18	86	18	79	11	84	37	90	35
Richmond	72	14	71	18	73	6	82	29	93	35
Shelbyville	69	14	74	19	66	4	84	31	88	34
South Fork	74	20	72	25	67	16	83	30	85	40

[1] Agent Union Pacific Railroad.

[2] E. C. Went.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
98	54	-----	-----	103	62	89	39	87	24	75	22	62	6	---
96	58	106	66	101	50	92	36	86	22	74	20	64	4	117
110	52	109	67	100	54	100	41	82	30	74	22	68	8	122
97	49	192	58	101	54	86	35	84	24	75	22	60	12	112
101	42	103	54	103	47	96	31	84	24	73	17	-----	-----	---
110	54	114	70	112	64	102	-----	84	-----	74	21	68	-----	124
100	56	108	70	102	52	93	32	-----	-----	-----	-----	-----	-----	---
101	63	108	58	105	50	90	38	85	-----	73	25	70	10	---
101	54	104	56	107	57	91	37	88	32	77	29	[g]65	[g]12	107
-----	-----	110	55	105	55	105	38	80	24	74	20	62	6	---
100	48	103	51	108	51	-----	-----	-----	-----	74	22	-----	-----	---
110	50	114	60	109	52	98	45	84	32	72	24	62	7	126
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
104	53	108	57	108	60	98	36	86	32	72	24	67	11	109
93	60	103	67	99	59	91	40	85	32	67	27	61	9	109
104	58	104	64	107	60	98	39	91	35	78	28	67	10	107
-----	-----	-----	-----	-----	-----	[i]88	[i]30	81	26	76	18	68	1	---
100	50	102	62	104	60	96	42	86	32	72	22	68	0	---
102	48	106	60	104	52	103	39	-----	-----	84	22	78	8	---
99	44	102	54	101	51	92	34	82	26	71	[i]19	71	6	112
104	42	106	53	104	50	98	36	82	24	[k]74	[k]20	66	6	115
104	60	110	-----	104	58	98	48	84	-----	72	22	70	14	114
107	-----	107	-----	105	-----	97	-----	84	30	72	23	64	9	---
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
-----	-----	-----	-----	-----	-----	102	44	84	30	74	24	70	12	---
107	51	112	56	109	58	98	37	87	31	73	23	70	10	---
110	50	110	48	112	52	95	47	82	32	70	24	65	10	117
98	52	102	58	102	59	94	37	86	33	72	24.	72	10	102
-----	-----	-----	-----	92	39	-----	-----	-----	-----	-----	-----	-----	-----	---
104	48	106	60	107	56	100	48	81	31	70	20	67	-----	118
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
-----	-----	-----	-----	-----	-----	94	40	-----	-----	-----	-----	-----	-----	---
100	59	100	57	96	55	88	47	79	35	76	30	58	17	---
97	64	100	60	97	55	89	45	84	28	75	26	63	18	85
-----	-----	-----	-----	-----	-----	86	49	-----	31	[h]72	28	60	22	---
95	58	96	55	96	55	89	44	86	32	77	30	70	21	86
-----	-----	-----	-----	92	50	85	47	80	30	[d]75	[d]23	[d]59	[d]18	---
98	54	100	50	97	47	91	44	87	27	74	20	64	14	94
96	64	96	67	93	60	90	49	85	33	81	27	68	21	79
98	52	100	47	99	44	95	38	86	27	77	19	59	14	---
92	56	94	56	92	51	86	45	82	31	73	26	58	14	88
98	60	96	59	96	55	91	46	85	35	73	27	59	17	84
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
94	61	93	57	92	52	86	44	83	30	79	23	57	14	87
101	52	101	44	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
95	55	96	54	96	49	89	41	86	33	74	23	55	13	89
[c]96	[c]49	98	49	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
100	51	100	54	101	49	90	40	85	33	74	23	58	18	97
100	54	100	52	100	51	91	40	86	23	74	24	66	16	89
-----	-----	-----	-----	-----	-----	-----	-----	82	29	77	22	59	12	---
98	54	99	50	96	45	92	39	86	29	72	23	58	12	95
91	62	92	57	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Louisiana:	°	°	°	°	°	°	°	°	°	°
Abbeville	80	31	81	35	80	27	83	50	89	59
Alexandria	----	----	----	----	----	----	----	----	91	50
Amite City	83	24	82	28	81	21	85	44	91	53
Baton Rouge	80	29	80	34	81	26	81	51	90	58
Cameron	85	27	101	31	89	23	89	47	95	39
Cheneyville	----	----	----	----	82	22	89	41	88	49
Clinton	79	23	81	32	84	28	85	46	95	51
Columbia	80	25	----	----	[1]84	[1]24	86	44	91	48
Convent	88	30	88	35	83	25	88	51	88	52
Coushatta[1]	80	23	82	24	86	20	----	----	94	45
Crowley	80	28	81	34	82	25	83	44	89	56
Davis	----	----	----	----	----	----	----	----	----	----
Donaldsonville	82	27	82	30	----	----	84	43	88	51
Edgard	80	37	82	41	82	31	84	54	86	57
Emilie	81	32	80	36	80	22	84	50	89	59
Farmerville	79	25	88	20	85	23	85	44	89	50
Girard	[1]80	[1]49	81	42	83	33	----	----	----	----
Grand Cane	79	25	81	21	87	20	84	45	92	50
Grand Coteau	81	28	80	30	81	26	82	48	87	55
Hammond	82	25	84	30	84	22	85	44	89	53
Homer	----	----	----	----	----	----	----	----	----	----
Houma	81	34	82	36	85	25	86	45	90	54
Jackson Barracks	----	32	----	32	----	25	85	53	88	56
Jeanerette	85	31	84	37	83	23	84	41	88	55
La Fayette	80	29	82	35	82	26	88	41	91	52
Lake Charles	82	25	85	20	81	26	85	55	98	50
Liberty Hill	81	25	82	26	87	19	89	37	95	45
Luling	83	31	83	30	82	23	85	41	87	44
Mandeville	79	27	81	33	84	22	87	44	95	51
Marksville	82	30	83	22	85	20	88	50	90	52
Maurepas	81	29	83	30	83	22	85	45	87	55
Melville	83	27	81	32	83	25	85	46	88	60
Minden	76	21	80	24	85	20	----	----	92	48
Monroe	76	26	76	28	82	20	----	----	91	52
Natchitoches	----	----	----	----	----	----	----	----	90	49
New Iberia	84	30	85	36	84	25	85	----	87	56
New Orleans	82	36	82	40	80	30	84	56	87	59
Paincourtville	----	----	----	----	83	23	85	46	91	53
Plaquemine	81	25	83	28	83	22	86	43	94	54
Port Eads	78	48	79	40	76	45	84	56	81	65
Port Eads[2]	78	48	79	40	76	45	80	56	81	66
Shell Beach	78	28	81	26	81	24	84	50	89	57
Shreveport	78	26	80	22	87	22	86	47	92	53
Sugar Exp't Station	80	32	81	36	80	27	84	42	88	56
Vidalia	83	28	83	32	80	25	----	----	92	44
Winnsboro	----	----	----	----	----	----	----	----	----	----
Maine:										
Bar Harbor	56	—12	53	— 2	46	6	62	25	68	35
Belfast	54	— 7	48	— 0	46	6	63	32	69	40
Calais	54	—18	49	— 7	54	— 5	65	19	70	31
Cornish	57	— 3	48	— 4	55	0	72	21	76	36
Eastport	52	—18	48	— 2	46	10	64	24	65	35
Fairfield	53	—20	47	—16	50	—16	67	21	71	29
Farmington	----	— 9	----	— 8	----	0	----	27	----	42
Fort Preble	----	----	----	----	----	----	----	----	73	34

[1] L. M. Howard. [2] Signal Service.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
93	66	93	71	90	71	89	53	87	45	....	....	79	31	...
98	62	98	66	97	65	96	46	90	36	84	28	....	....	...
97	66	98	67	97	64	95	54	92	35	82	29	80	24	77
95	68	98	66	96	62	94	50	92	34	84	31	80	25	73
101	44	102	65	102	65	100	49	94	40	88	35	82	25	77
94	61	96	63	98	62	92	47	88	34	86	26	....	....	...
d97	d58	102	60	94	60	90	50	87	43	81	40	d79	d30	79
97	65	97	67	96	62	....	....	....	....	....	....	....	....	...
....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
97	63	98	66	100	60	94	46	90	35	82	30	....	....	...
90	63	92	69	92	68	89	55	89	40	83	34	81	27	67
....	....	....	....	....	....	88	51	c85	c33	78	28	72	23	...
92	63	94	65	92	64	89	49	....	....	....	....	....	....	...
91	63	93	69	91	70	89	56	88	44	84	38	81	32	62
94	70	97	68	91	68	90	54	88	40	83	35	79	28	75
93	65	95	63	95	64	87	53	87	40	79	35	72	37	75
....	....	....	....	94	52	....	....	....	....	....	....	....	....	...
95	64	....	....	94	67	92	47	....	....	....	....	74	26	...
91	63	93	66	92	67	89	49	86	37	82	33	79	27	67
96	68	95	68	94	67	90	55	....	....	....	....	....	....	...
....	....	....	....	93	65	89	55	84	40	77	36	73	30	...
92	68	93	70	92	70	90	50	88	42	....	....	82	27	...
94	69	97	69	94	69	92	57	90	42	85	35	76	31	72
95	66	96	69	97	68	94	50	91	39	85	32	81	27	74
96	64	98	68	96	66	93	49	90	38	84	31	....	....	...
98	60	100	59	99	60	94	42	83	40	82	30	80	32	80
96	62	101	63	99	59	98	48	90	35	81	29	78	21	82
92	57	96	65	91	61	90	53	88	38	....	....	d78	d27	...
101	68	99	68	99	68	96	56	90	37	82	32	77	27	74
96	58	98	74	96	55	....	....	87	33	80	36	76	28	...
92	69	96	68	91	68	90	41	88	40	81	32	72	23	74
95	68	96	70	94	66	92	53	89	36	85	30	82	26	71
98	61	99	62	98	59	99	46	88	35	81	32	75	24	...
95	64	96	65	95	61	92	50	86	37	80	35	72	25	...
96	73	98	64	96	61	92	41	89	35	81	28	....	....	...
92	66	95	70	93	69	95	53	90	41	84	34	81	29	70
94	69	96	68	91	67	89	56	87	49	81	44	80	35	66
96	69	97	68	93	69	95	53	88	40	84	32	....	....	...
97	62	102	63	96	62	97	48	....	....	83	24	82	24	...
92	69	92	68	90	71	....	....	....	....	....	....	....	....	...
92	69	92	68	....	....	....	....	....	....	80	50	47	40	...
94	65	94	69	92	69	89	51	87	44	79	38	....	....	...
97	61	99	68	96	65	92	48	88	40	80	34	76	27	77
f94	f68	95	69	92	67	90	56	87	38	82	39	78	33	68
97	66	....	....	....	....	....	....	....	....	....	....	....	....	...
97	60	96	61	94	56	....	....	....	....	86	45	79	40	...
83	45	86	44	86	49	76	38	75	30	56	14	49	-9	98
80	48	84	56	84	56	76	42	69	36	56	18	35	-8	92
86	42	86	46	90	45	75	32	76	27	61	10	53	-10	108
84	45	88	51	92	50	77	36	73	27	56	6	35	-7	99
71	44	82	48	80	52	73	37	76	35	55	16	52	-10	100
88	40	90	42	92	41	77	30	75	20	55	10	42	-26	118
....	47	....	53	....	50	....	34	....	28	....	11	....	-20	...
....	41	93	47	88	47	80	33	73	28	61	13	41	-5	...

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°
Maine—Continued.										
Gardiner	56	— 9	56	— 2	49	— 5	-----	-----	74	32
Kennebec Arsenal	56	— 0	42	— 5	50	— 6	67	18	72	32
Kents Hill	57	—12	48	— 8	57	— 2	66	22	72	32
Lewiston	53	— 9	51	— 4	46	—10	65	22	72	30
Mayfield	-----	-----	-----	-----	-----	-----	66	17	68	24
Orono	58	—23	46	— 9	47	—10	64	22	73	33
Petit Menan	50	— 8	45	4	41	14	64	28	60	38
Portland	62	— 3	58	0	51	5	70	24	75	36
West Jonesport	45	—12	48	1	48	8	65	26	66	38
Maryland:										
Baltimore	73	20	74	23	77	12	83	31	87	43
Barren Cr'k Springs	74	16	71	25	77	13	78	25	82	40
Cumberland[1]	72	14	70	17	72	3	78	24	80	41
Cumberland[2]	74	15	76	19	71	4	82	27	82	40
Fallston	67	19	74	20	71	7	80	29	81	41
Fort McHenry	70	18	71	21	77	10	80	31	82	41
Frederick	74	17	74	24	75	12	85	29	84	41
Gaithersburg	-----	16	68	22	74	11	75	31	-----	44
Galena	-----	20	-----	25	-----	11	-----	37	-----	44
Jewell	-----	21	-----	24	-----	15	-----	34	-----	46
Leonardtown	72	19	73	26	74	15	-----	-----	-----	42
McDonogh	69	11	66	20	69	9	75	28	85	39
Mount St. Mary's	65	8	70	12	72	4	84	25	81	39
Woodstock	71	14	-----	-----	72	10	80	23	81	39
Massachusetts:										
Amherst[3]	62	5	59	2	60	— 6	77	22	[a]80	33
Amherst[4]	62	4	60	3	60	—10	78	22	79	32
Amherst[5]	62	4	-----	-----	62	— 6	80	22	80	32
Andover	64	5	55	0	60	— 1	73	23	81	34
Blue Hill (summit)	62	5	61	0	64	— 1	70	21	77	36
Blue Hill (base)	64	8	64	0	66	1	71	22	79	38
Blue Hill (valley)	63	2	65	— 3	66	— 2	72	23	81	36
Boston	66	8	64	5	68	4	72	26	80	39
Brewster	59	15	64	11	57	13	73	30	72	34
Cambridge[6]	62	6	60	0	62	2	71	25	77	36
Cambridge[7]	63	7	62	3	62	3	72	24	78	37
Chestnut Hill	64	5	63	— 2	65	1	72	22	82	34
Concord	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Cotuit	63	10	58	7	60	5	67	24	70	35
Deerfield	60	8	56	— 1	56	— 6	80	28	84	39
Dudley	55	9	62	5	66	— 2	75	28	79	36
Fall River[8]	60	12	60	10	66	4	71	23	72	42
Fall River[9]	-----	-----	61	7	72	2	78	23	76	38
Fitchburg[10]	58	7	55	— 2	59	0	71	26	78	40
Fitchburg[11]	60	6	59	0	64	— 1	73	23	78	34
Fort Warren	52	9	47	3	48	2	75	25	72	38
Framingham	65	6	62	— 1	64	— 3	72	24	81	34
Gilbertville	58	9	57	— 4	60	— 3	76	20	80	31
Groton[12]	64	6	60	— 7	62	0	76	22	81	35
Heath	66	0	50	— 6	62	— 4	80	18	80	26
Kendall Green	65	2	54	— 4	63	2	76	26	84	36

1 E. T. Shriver.
2 Howard Shriver.
3 Miss S. C. Snell.
4 Agricultural Experiment Station.
5 Hatch Experiment Station.
6 Harvard College Observatory.
7 E. C. Brooks, C. E.
8 C. V. S. Remington.
9 Patrick Kierman.
10 Dr. J. Fisher.
11 Dr. A. P. Mason.
12 Chas. Woolley.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
78	45	88	47	88	49	76	35	72	23	58	10	33	—20	108
83	42	87	44	88	47	75	35	76	26	54	9	35	—12	100
88	42	91	48	93	47	76	31	77	23	55	10	37	—16	109
81	36	85	45	90	44	76	31	76	21	50	6	----	----	---
82	44	86	46	90	45	76	33	78	24	55	12	47	—36	126
72	44	93	50	75	50	69	45	62	37	55	19	45	— 5	101
87	46	93	51	88	49	79	37	75	32	60	13	41	— 4	97
70	46	78	52	78	51	74	38	66	30	52	18	40	— 6	90
93	55	98	55	95	51	87	46	78	36	73	26	59	18	86
90	52	93	50	92	47	87	44	74	31	74	20	57	18	80
92	48	94	54	92	45	80	38	76	36	66	22	56	11	91
93	49	100	55	98	48	86	39	78	38	72	24	66	13	96
90	52	95	52	----	----	----	42	73	32	71	21	53	14	---
92	50	90	64	93	48	84	44	76	34	70	24	51	15	83
92	51	97	53	94	50	86	43	76	37	71	24	58	15	85
92	56	----	60	----	54	----	46	----	32	----	23	----	16	---
----	62	----	----	----	----	----	----	----	----	----	----	----	----	---
----	62	----	66	----	61	----	54	----	38	----	26	----	20	---
90	52	92	52	90	53	84	43	72	35	70	24	65	18	83
92	45	----	----	----	----	84	41	75	31	69	15	55	11	---
92	46	96	48	91	45	85	39	74	28	69	19	53	12	---
[a]86	[b]39	94	42	86	43	78	30	72	26	58	11	46	— 5	100
86	38	92	41	86	42	78	30	76	26	60	13	42	— 6	102
88	40	94	40	88	42	80	28	78	26	57	16	44	— 5	---
85	47	92	47	87	45	82	34	76	30	70	11	47	2	93
83	48	92	46	87	46	80	35	73	32	63	11	53	— 1	93
84	45	92	47	87	47	81	34	72	31	66	12	55	0	92
86	40	94	42	89	43	83	31	75	28	67	12	55	0	97
87	50	95	52	89	50	83	39	77	36	64	15	56	0	95
85	44	95	51	86	51	83	41	73	35	65	20	52	7	88
84	46	91	51	91	48	80	37	70	32	62	11	49	1	91
85	47	93	51	88	50	82	37	73	32	62	15	52	2	91
88	42	84	47	90	48	84	36	78	31	65	14	54	1	96
----	----	95	46	89	48	82	32	75	28	62	13	50	— 2	---
83	45	90	48	84	50	78	39	68	34	62	16	47	5	85
89	49	98	50	91	38	80	34	75	31	60	11	56	— 9	107
89	41	90	55	87	52	81	34	79	32	64	10	49	— 2	92
83	50	90	50	82	52	80	38	72	33	63	15	54	6	86
----	----	92	50	----	----	----	----	----	----	----	----	----	----	---
85	46	92	53	86	52	78	39	72	32	58	14	42	— 4	96
86	43	92	44	85	74	78	34	74	27	63	12	45	— 6	98
82	51	90	52	89	42	76	35	70	26	59	15	41	5	88
88	42	95	47	88	47	82	30	74	28	65	13	50	— 1	98
87	39	92	40	87	40	81	32	70	24	60	10	43	— 6	98
86	45	92	47	86	48	84	33	74	24	61	12	48	— 2	99
90	40	93	42	90	44	80	28	76	26	52	8	[d]38	— 8	101
84	50	94	50	90	50	86	32	72	29	64	12	50	0	98

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Massachusetts—Cont'd.	°	°	°	°	°	°	°	°	°	°
Lake Cochituate	66	3	65	-5	67	-4	74	19	83	31
Lawrence	62	-3	57	-3	60	0	74	23	81	34
Leicester	58	6	57	0	63	-1	72	19	79	32
Long Plain	62	6	64	4	58	2	72	24	76	38
Lowell[1]	62	6	58	2	62	2	71	24	79	36
Lowell[1]	66	3	60	-2	62	0	73	23	82	34
Lowell[2]	65	6	60	2	67	4	75	22	84	34
Ludlow[3]	61	4	67	4	60	-6	81	21	81	34
Ludlow[4]	58	3	60	-4	63	13	75	15	77	29
Lynn	63	8	60	5	----	----	71	25	75	39
Mansfield	63	-2	59	-2	67	-2	74	22	78	33
Middleboro	61	0	65	1	71	1	76	21	77	31
Milton	62	10	62	0	67	7	72	29	79	34
Monson	63	3	61	-1	65	-8	77	12	80	30
Nahant	58	10	57	6	61	13	67	28	72	40
Nantucket	56	17	55	12	54	14	58	30	67	36
New Bedford[5]	60	10	60	9	62	4	65	23	75	38
New Bedford[6]	62	7	63	9	65	2	71	23	75	34
Newburyport[7]	65	5	60	-2	62	4	75	25	82	37
Northampton	60	8	51	4	52	0	72	25	81	37
North Billerica	65	6	62	0	63	4	75	23	86	37
Plymouth	----	----	61	8	66	7	70	26	80	42
Princeton	58	3	56	-6	58	5	69	19	76	32
Provincetown	----	----	55	9	60	13	69	30	76	38
Royalston	62	0	52	2	60	0	74	30	78	44
Salem[8]	----	----	54	3	61	3	74	29	79	42
Somerset	60	9	66	4	70	0	81	22	83	38
South Hingham	----	----	----	-4	----	-1	----	18	----	30
Springfield Armory	61	10	60	5	65	2	76	26	80	38
Taunton[9]	64	6	65	6	70	2	74	25	82	34
Taunton[10]	62	6	66	6	73	2	79	24	82	32
Taunton[11]	62	-1	66	3	73	-4	75	23	79	30
Vineyard Haven	62	12	63	12	63	10	75	28	75	37
Wakefield	60	6	57	-3	50	2	71	21	81	33
Wellesley	63	-2	63	6	65	-4	79	20	78	34
Westboro	64	5	60	2	66	0	79	23	86	37
Williamstown	60	2	55	0	58	-10	73	23	73	31
Woods Holl	55	14	56	12	49	10	58	28	66	42
Worcester[12]	61	6	62	4	62	0	72	27	81	40
Michigan:										
Adrian	66	11	64	11	60	2	79	22	90	28
Albion[13]	60	4	61	14	54	2	72	25	83	33
Allegan	----	----	----	----	----	----	----	----	----	----
Alma	61	2	59	4	52	-11	75	12	85	27
Alpena	51	2	49	6	44	-13	75	13	78	26
Ann Arbor	63	2	61	10	53	0	73	22	82	33
Atlantic	50	1	34	1	34	-10	54	20	61	22
Ball Mountain	62	2	59	10	58	-1	73	18	81	30
Bangor	60	5	63	16	57	-7	78	19	90	29
Bear Lake	43	0	50	7	47	-22	70	6	82	22
Bell Branch	58	2	62	12	50	5	66	28	79	33
Benton Harbor	65	11	66	17	59	-4	80	23	92	33

1 Prop. locks and canals.
2 F. E. Saunders.
3 M. W. Graves.
4 J. Haviland.
5 T. A. Rodman.
6 New Bedford waterworks.
7 T. V. Pike.
8 J. P. Andrews.
9 Dr. E. W. Jones.
10 A. F. Sprague.
11 Taunton waterworks.
12 J. B. Hall.
13 Prof. Chas. E. Barr.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
89	41	97	37	90	38	86	24	78	21	65	5	53	— 2	102
87	41	100	48	94	48	81	34	76	30	60	12	47	— 3	103
86	43	90	46	[d]84	[e]45	78	35	72	32	60	10	49	— 2	92
84	52	90	56	86	50	80	34	72	31	68	12	48	1	89
86	45	92	48	87	49	80	33	75	29	62	13	46	— 4	96
88	44	94	44	88	46	79	32	75	27	62	10	48	— 2	96
90	46	98	49	93	51	86	34	84	31	67	14	48	0	98
87	38	94	42	84	40	78	29	75	26	60	6	45	— 8	102
86	37	91	38	94	46	82	31	79	27	66	9	47	— 6	107
83	49	91	49	84	49	80	35	68	32	61	13	46	— 1	...
86	41	94	44	88	44	83	30	77	31	66	13	45	0	96
85	37	91	41	84	45	82	29	74	25	69	8	54	1	91
85	49	94	42	88	50	78	33	73	32	65	16	50	5	94
78	36	98	38	87	44	80	28	75	22	65	8	48	—10	108
84	48	91	50	87	51	80	39	[b]66	[b]37	61	17	49	7	85
75	49	82	55	80	55	77	48	70	41	60	25	52	11	71
84	48	90	50	80	53	78	37	69	34	64	14	47	3	87
84	44	93	46	82	50	79	35	72	32	66	15	53	5	91
86	46	94	50	89	47	83	37	76	33	63	15	50	1	96
91	47	96	46	91	45	85	36	74	32	56	15	41	1	96
95	45	97	45	93	48	83	31	75	28	63	13	49	0	97
85	52	90	56	86	55	82	44	71	37	66	18	58	2	...
...	...	88	44	84	45	77	34	73	30	...	8	...	6	...
83	44	94	54	84	54	78	38	70	38	...	...	51	10	...
86	50	90	56	86	52	78	36	...	...	[c]60	[c]16	44	0	...
87	50	94	55	88	55	78	43	...	...	...	...	...	...	...
92	48	99	50	93	50	92	34	76	30	72	14	50	3	99
...	37	...	41	...	45	...	28	...	25	...	9	...	0	...
88	47	95	43	88	48	80	34	73	31	62	14	46	0	95
90	44	94	48	88	47	85	35	81	30	69	15	55	2	92
88	44	93	47	88	47	85	35	75	30	69	14	55	3	91
87	37	94	41	87	44	83	29	78	26	70	10	56	1	98
86	50	92	52	85	55	82	44	80	40	68	21	56	11	82
86	42	93	45	88	46	81	30	76	27	61	12	53	0	96
86	42	93	43	92	47	81	31	70	26	65	18	52	— 1	97
94	44	98	46	92	48	86	32	77	27	65	12	52	— 2	100
81	40	...	...	...	...	...	...	...	...	...	...	...	...	...
76	40	81	55	78	55	76	44	70	40	62	18	54	6	75
87	47	94	49	87	50	78	40	73	32	61	14	46	— 2	96
98	37	98	44	102	40	89	35	82	30	68	17	45	5	100
92	43	90	49	95	44	85	34	76	31	62	22	46	11	93
...	...	...	...	98	35	88	30	79	28	66	21	51	5	...
94	38	94	42	94	35	94	28	77	26	63	23	49	1	105
89	38	88	44	81	40	89	32	68	28	57	22	47	1	102
92	42	91	50	93	43	84	36	74	28	64	18	45	9	93
76	40	91	48	76	45	...	...	54	21	42	17	44	4	...
89	39	91	43	94	42	84	37	54	21	62	16	44	4	95
100	40	100	30	104	37	92	31	81	31	63	28	49	3	111
91	34	90	38	89	33	82	24	71	25	52	22	43	— 2	113
92	40	94	48	86	32	...	...	76	30	60	17	40	8	...
97	43	98	41	100	42	90	40	79	35	66	25	52	8	104

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Min.	Max.	Max.	Min.
Michigan—Continued.	°	°	°	°	°	°	°	°	°	°
Benzonia	43	— 1	49	8	45	— 6	72	12	83	24
Berlin	63	2	61	11	54	— 5	80	18	84	30
Berrien Springs[1]	58	6	64	14	55	— 5	76	27	88	32
Big Rapids	48	— 2	54	9	48	—15	76	12	86	24
Birmingham	62	3	61	11	55	3	75	21	83	32
Bronson	58	2	60	12	50	0	70	26	80	32
Buchanan	62	2	62	11	54	— 5	72	24	83	32
Calumet	44	— 3	47	— 4	49	— 8	65	16	72	22
Caldwell	45	— 7	50	6	46	—21	74	4	86	22
Cassopolis	62	4	62	13	55	— 3	76	25	88	33
Charlevoix	48	— 5	44	5	48	—26	74	11	76	27
Chase	47	—10	52	2	46	—24	74	7	84	20
Cheboygan							72	6	78	24
Chelsea	63	3	62	5	58	0	77	16	86	28
Clinton	64	2	62	10	57	2	76	21	87	28
Colon	57	6	62	14	50	0	70	25	84	31
Columbiaville	55	3	58	10	50	0	78	22		
Concord	62	1	62	13	54	— 1	75	19	90	29
Crawford							65	14	84	26
Crystal Falls	43	—20	50	— 5	56	—26	73	1	77	20
Detroit	66	5	63	12	57	4	74	25	84	32
Detroit							77	24	86	30
East Tawas	50	6	55	1	57	—10	73	21	75	30
Eden	61	— 1	62	9	54	— 5	76	22	88	30
Escanaba	42	—11	41	— 2	47	—21	74	6	77	22
Evart	47	— 8	53	2	47	—27	63	2	80	20
Fairview							75	22	82	29
Fitchburg									86	28
Flint	62	3	61	7	52	— 4	76	12	83	28
Fort Brady	40	—15	46	—16	50	—34	[h]66	—[h]2		
Fort Mackinac	40	1	41	1	43	—14	58	16	63	26
Fort Wayne	66	4	62	11	58	3	76	23	84	30
Fremont	49	— 1	54	8	48	—13	74	15	83	26
Gaylord	37	3	47	1	37	—31	61	1	78	30
Gladwin	51	1	53	5	46	—17	76	17	85	25
Grand Haven	61	5	51	13	51	— 4	70	22	78	28
Grand Rapids	61	1	59	11	57	—10	79	18	88	27
Grape	65	2	64	11	56	0	76	21	84	29
Grayling	48	— 1	46	2	44	—35	75	5	82	22
Gulliver Lake	41	—14	39	— 4	46	—26	59	1	76	21
Hanover	62	3	61	7	54	1	74	19	84	30
Harbor Springs									84	32
Harrison	[i]45	—[i]4	51	0	50	—14	77	12	83	25
Harrisville	51	— 1	50	— 8	49	—14	77	21	73	27
Hart	54	0	52	10	50	—15	75	12	83	24
Hastings	61	1	61	11	52	— 2	73	20	85	30
Hayes	59	4	62	9	53	— 7	81	29	90	29
Highland Station	60	1	59	10	50	— 1	75	20	82	29
Hillsdale	61	5	64	14	53	0	77	25	87	30
Howell							70	19	84	27
Hudson	65	— 3	63	5	59	— 3	80	19	86	25
Ionia	60	0	60	5	47	5	70	11	87	20
Ivan	45	— 6	49	3	44	—19	76	6	85	24
Jackson										

[1] F. A. Zerby.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
94	40	96	42	101	40	92	31	79	26	63	19	47	7	106
97	46	94	46	99	47	88	40	76	34	65	26	50	9	104
		93	40											
92	40	94	44	96	40	86	34	74	27	65	12	49	5	93
90	40	93	46	94	42	82	30	72	28	52	18	42	2	94
90	45													
90	39	91	44	84	44	74	34	68	27	45	17	43	1	99
94	35	94	42	91	33	83	26	71	26	57	20	45	0	115
93	40	93	48	96	43	86	36	76	25	64	25	46	11	99
89	39	92	47	87	43	84	29	70	32	55	21	46	2	118
96	35									58	20			...
88	34	91	41	84	35	84	25	68	27	50	20	45	—3	...
85	35	94	43	98	32	89	28	80	25			48	4	...
98	35	98	44	101	39	89	31	82	28	66	13	47	5	99
92	42	94	47	96	42	84	34	76	26	58	24	41	13	96
				94	44									
95	41	95	44	97	38	87	32	78	27	61	17	44	8	98
		93	41	94	38									
88	40	91	40	84	31	78	22	74	24	50	13	46	—1	117
94	45	96	52	92	46	85	39	74	29	66	21	48	10	92
93	41	98	48	95	42									...
95	40													...
92	42	93	48	06	40	89	32	70	25	65	17	47	6	101
96	42	90	43	89	34	79	28	72	28	55	18	47	2	117
90	31	86	38	85	30			73	23	60	17	45	—9	...
92	41	95	42	99	40	86	32			65	19	45	11	...
95	36	95	42	97	36	88	30	77	25	68	13	46	3	...
92	37	96	44	99	38	92	31					47	4	...
87	34	88	40	82	35	80	32	72	28	52	4	42	—5	...
79	40	81	47	77	45	75	35	62	29	48	21	44	3	95
95	39	97	47	94	40	88	34	75	26	65	13	49	5	94
95	42	91	43	05	37	86	29	74	26	57	23	52	—2	108
90	35			88	36	79	31	61	22	50	19	44	—11	...
95	35							76	24	63	20	42	—4	...
89	43	86	48	90	42	83	34	78	32	56	27	48	6	94
97	39	97	42	98	37	92	33	79	26	59	23	48	3	108
99	36	96	42	96	44	86	36	73	29	65	18	55	8	99
95	32	90	38	92	31	91	22	74	23	56	18	45	—14	130
90	42	84	43	80	35	73	27	70	24	50	19	41	1	116
94	40	92	47	96	42	85	34	76	31	64	19	55	6	95
96	38	94	42	91	37	85	27	77	26			46	2	...
95	35	94	40	95	35	88	29	74	27	52	16	41	—6	109
90	32	92	39	86	36	82	30	70	26	58	22	46	—2	106
95	36	90	38	96	40	83	24	74	24	60	25	50	10	111
94	42	93	48	94	40	85	32	76	30	61	22	48	11	96
91	40	90	46	88	36	88	31	70	31	62	26	49	7	98
92	38	93	44	95	40	88	32	72	26	70	11	45	1	96
93	44	94	48	96	40	85	33	77	32	63	18	45	4	96
95	34	95	41	99	36	90	29	76	25	61	14	47	3	...
93	33	95	40	98	36	84	28	81	83	68	12	50	1	101
95	40	95	42	99	41			79	30	69	18	48	—5	...
98	33	95	40	92	33	86	25	76	26	54	20	45	1	117
				100	38	85	30	74	27	[a] 63	[a] 18	48	10	...

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Michigan—Continued.	°	°	°	°	°	°	°	°	°	°
Jeddo	56	3	56	10	50	0	76	21	76	30
Kalamazoo	62	6	62	11	54	0	74	23	85	35
Lansing[1]	63	0	61	10	56	— 4	75	21	84	29
Lansing[2]	63	1	61	10	51	— 3	75	20	84	30
Lathrop	41	—16	44	— 4	41	—26	68	4	75	21
Madison	61	3	62	14	58	1	78	22	89	30
Manistee	45	2	52	10	46	— 7	72	20	78	30
Manton	45	— 7	50	6	46	—21	74	4	86	22
Marquette	46	— 6	45	0	40	—12	69	14	78	24
Marshall	62	1	62	12	55	— 2	77	18	87	29
May	60	1	58	7	51	— 6	76	17	80	28
Mio	50	— 1	62	— 3	42	21	----	----	85	22
Montague	49	0	50	8	45	—11	69	20	80	28
Mottville	64	0	64	4	59	— 3	78	20	89	28
North Marshall	60	3	55	7	52	— 4	73	16	81	27
Northport	----	----	----	----	----	----	----	----	----	----
Olivet	58	— 2	62	8	52	— 5	75	18	79	29
Otsego	62	1	62	11	59	— 4	77	24	88	27
Ovid	61	3	58	10	50	— 5	75	14	86	29
Paw Paw	63	7	63	11	59	—10	76	18	88	28
Pontiac	60	6	60	14	52	4	72	24	76	34
Port Huron	64	4	60	11	54	2	72	22	76	34
Pulaski	59	4	56	15	50	0	70	20	82	30
Rawsonville	65	4	62	16	58	3	80	20	85	32
Romeo	62	3	60	8	54	— 1	75	20	84	31
Roscommon	45	— 7	50	4	45	—32	75	9	84	22
St. Ignace	44	— 4	40	— 5	45	—23	67	9	78	24
St. Johns	53	3	60	13	55	— 3	77	18	86	29
Sand Beach	57	9	57	8	50	— 3	74	20	73	25
Sault de St. Marie	39	—11	42	—11	44	—27	66	3	72	24
Standish	----	----	----	----	----	----	----	----	----	----
Stanton	60	0	55	4	48	—10	75	15	83	25
Thornville	63	3	61	7	52	— 2	77	20	83	32
Vandalia	58	5	60	12	53	— 2	72	24	84	30
Washington	62	3	60	9	52	0	76	19	78	31
Weldon Creek	50	10	58	9	46	—17	81	12	83	24
West Branch	49	0	47	2	46	—13	70	10	83	24
Williamston	68	4	60	21	50	0	74	30	80	30
White Pigeon	----	----	----	----	----	----	----	----	----	----
Ypsilanti[3]	60	4	57	10	52	1	73	21	82	28
Ypsilanti[4]	66	5	62	15	58	5	76	24	80	33
Minnesota:										
Crookston	43	—36	43	—32	45	—25	81	20	88	16
Duluth	44	—19	52	—13	52	—11	68	17	76	29
Farmington	----	----	46	—12	48	—14	80	18	84	30
Fort Snelling	45	—22	49	—12	50	—20	83	17	86	27
Grand Meadow										
Lake Winnibigo-	----	----	----	----	44	—21	79	23	89	26
shish Dam	45	—30	44	—25	48	—25	71	10	79	26
Leech Lake Dam	46	—35	45	—27	46	—34	72	— 4	82	20
Le Sueur	43	—24	d48	—11d	52	—18	d83	d25	87	33
Mankato	49	—16	52	— 8	55	—14	81	22	85	30
Medford	----	----	----	----	50	—28	84	15	83	28
Minneapolis	42	—21	47	—12	50	—15	77	21	84	31

[1] Dr. H. B. Baker. [2] Signal service. [3] J. C. Bemiss. [4] C. S. Woodard.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
90	40	90	50	88	40	85	42	72	29	60	25	44	12	90
92	50	94	52	100	42	86	36	76	32	64	26	50	13	100
92	39	92	43	95	39	89	30	76	26	62	20	47	9	99
94	40	94	44	96	40	89	32	76	26	62	21	47	10	99
90	40	94	40	87	30	81	30	70	26	50	14	42	— 5	120
97	39	96	47	98	43	86	36	78	30	65	18	46	9	97
84	44	89	48	91	40	84	34	67	31	53	26	45	8	98
94	35	94	42	91	33	83	26	71	26	57	20	44	0	115
89	40	91	46	84	39	81	34	70	28	50	19	48	3	103
97	47	96	43	99	40	88	31	77	28	63	19	46	6	101
90	40	93	46	98	40	92	36	75	25	61	24	46	8	104
				90	35					59	22			---
89	38	85	42	88	38	80	30	73	31	53	27	45	2	100
95	37	96	42	101	39	90	34	73	31	53	27	49	5	104
91	32	94	46	97	41			76	25	69	11	45	5	---
						82	31	67	30	51	20	46	11	---
91	39	90	44	94	38	86	34	74	25	61	18	46	7	99
96	36	98	43	99	35	90	30	80	28	64	20	48	9	103
94	38	96	43	98	39	90	31	73	26	60	26	44	7	103
96	36	96	41	99	31	90	29	78	30	65	20	49	6	109
87	45	88	54	89	47	82	42	70	31	62	23	48	11	85
94	40	95	47	93	44	87	40	73	27	63	23	47	5	93
92	42	95	50	90	42	82	42	74	32	60	20	42	13	95
96	44	98	43	100	44	86	34	74	29	68	14	48	8	97
93	39	95	48			74	37	75·	26	63	20	46	6	---
93	31	93	35	90	30	85	19	73	21	57	17	46	—12	125
84	38	85	45	83	38	83	30	64	28	45	20	42	3	108
97	40	93	49	95	39	91	31	74	27	63	24	48	9	100
89	37	93	42	92	40	86	33	67	28	64	23	47	6	96
86	36	86	44	82	38	79	33	70	29	49	15	42	— 7	113
		96	42	98	38	89	28	79	25	50	12	40	— 4	---
95	35	92	41	96	35	88	29	73	24	63	20	48	5	106
91	42	94	49	98	42	90	35	75	29	65	23	48	8	100
92	40	92	46	96	42	84	36	75	33	62	24	45	13	98
89	39	92	44	95	40	86	32	74	26	63	19	48	3	95
94	36	91	38	94	31	85	24	74'	24	57	25	47	5	111
92	34	92	41	90	37	86	27	72	26	59	21	47	— 4	105
90	40	90	50	95	40	84	35	74	32	62	26	54	12	95
90	40	92	42	98	38	86	30	74	28			46	2	---
90	37	92	43	94	39	82	32	70	26	63	11	40	4	93
91	42	93	49	94	44	85	37	72	28	65	16	45	8	89
96	42	100	38	94	33	85	29	79	28	60	4	48	—22	136
91	41	92	48	86	45	81	35	66	24	53	14	50	— 5	111
92	54	96	50	92	44	80	32	66	24	54	8	46	0	---
94	49	98	46	94	39	84	30	63	19	61	7	54	— 6	120
100	50	99	49	97	42	89	29	68	16	60	6	47	1	---
94	49	91	52	84	46	78	31	73	25	56	5	40	—17	124
94	37	91	43	88	36	78	25	75	21	59	— 4	44	—21	129
95	54	97	60	[c]93	[c]46	85	34	[d]72	[d]20	[c]59	[c]3	[d]50	—[d]1	121
90	50	94	55	91	43	84	33	70	23	62	9	55	— 8	110
91	42	95	43	92	36	87	24	72	15	62	— 1			---
94	54	95	58	94	50	85	35	70	20	55	8	51	— 1	116

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°
Minnesota—Continued.										
Montevideo	43	-26	47	-20	54	-17	81	17	87	24
Moorhead	40	-31	47	-26	44	-22	82	10	84	14
Morris	45	-27	44	-21	49	-20	78	28	84	20
Northfield	41	-25	49	-10	47	-23	83	17	85	26
Owatonna	40	-24	47	-11	52	-19	81	16	----	----
Pine River	41	-36	44	-25	45	-36	70	10	81	26
Pokegama Falls	45	-38	42	-36	46	-40	71	-17	81	16
Redwing	46	-21	51	-7	46	-17	81	18	90	30
Rolling Green	41	-20	49	-18	48	-14	75	19	84	31
St. Charles	45	-18	50	-9	50	-20	80	19	85	31
St. Paul	42	-22	51	-12	51	-16	83	19	86	27
St. Vincent	32	-38	38	-36	40	-30	75	13	82	15
Sheldon	----	-25	----	-4	----	-20	----	27	----	34
Mississippi:										
Aberdeen	----	----	----	----	----	----	----	----	88	38
Agricultural College	76	25	76	23	80	19	84	47	90	50
Batesville	78	24	80	26	80	19	86	35	94	44
Bay St. Louis	----	----	----	----	----	----	----	----	----	----
Booneville	78	23	79	22	86	14	83	40	89	42
Brookhaven	82	24	81	27	85	21	86	38	91	45
Canton	----	27	----	32	----	23	82	47	86	49
Columbus[1]	79	24	84	28	84	18	84	39	98	41
Columbus[2]	79	24	84	28	84	18	93	41	98	40
Corinth	----	----	----	----	----	----	----	----	90	42
Edwards	80	27	80	29	83	21	85	47	94	50
Enterprise	----	----	----	----	----	----	----	----	----	----
Fayette	81	22	81	32	84	23	85	44	90	51
Greenville	79	26	----	----	77	21	81	53	94	52
Hattiesburg	----	----	----	----	----	----	85	49	91	52
Hazlehurst	----	----	----	----	----	----	----	----	91	47
Hernando	----	----	----	----	----	----	----	----	88	36
Holly Springs[3]	72	[d]24	76	26	73	18	80	40	86	50
Holly Springs[2]	----	----	----	----	----	----	----	----	90	42
Jackson	80	26	80	[1]28	----	----	----	----	93	46
Kosciusko	82	25	80	28	81	20	85	44	86	42
Lake	79	23	81	25	85	16	87	34	91	39
Logtown	79	31	82	33	81	24	84	46	88	54
Louisville	80	20	84	23	84	15	88	38	92	40
Macon	[g]80	[g]31	----	----	81	26	84	53	92	40
Meridian[4]	79	26	80	29	82	19	85	40	89	41
Moss Point	78	32	80	36	81	25	84	50	89	54
Natchez[6]	----	----	80	38	82	25	82	50	85	53
Natchez[2]	----	----	----	----	----	----	----	----	92	44
Okolona	----	----	----	----	----	----	----	----	94	40
Palo Alto	79	26	81	28	81	20	86	46	86	50
Pearlington	97	31	82	33	80	30	84	46	88	54
Pontotoc	76	25	79	25	82	18	84	38	87	39
Port Gibson	82	23	82	26	84	20	85	42	91	40
Rienzi	----	----	76	28	77	18	86	44	80	46
Summit	88	28	79	27	81	24	[f]83	[f]44	----	----
University	76	24	78	26	77	17	84	41	88	45
Vaiden	----	----	87	26	85	19	88	38	96	41
Vicksburg	82	28	79	32	81	24	83	51	88	50
Washington	81	24	82	30	84	23	84	45	91	51

[1] Miss H. Quinche. [2] Cotton Belt. [3] Dr. T. B. Shuford. [4] W. H. Swan. [6] Signal Service.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
91	44	93	50	94	38	84	31	71	20	69	4	63	—13	120
91	44	98	46	93	36	86	30	76	24	63	2	47	—18	129
92	48	92	50	97	37	87	31	75	24	59	3	48	—13	124
92	52	94	51	92	42	87	28	69	19	60	2	53	—10	119
94	50	91	46	88	46	80	26	75	22	60	— 7	42	—19	130
94	43	92	38	89	34	81	24	76	12	59	— 7	44	—24	132
92	52	93	49	92	44			68	21	56	7			
90	52	93	58	89	40	84	31	70	21	56	6	52	—10	113
93	54	94	53	91	45	85	31	76	19	62	8	50	1	114
94	51	94	51	92	43	84	31	71	22	59	9	53	— 3	116
94	40	95	43	92	30	82	29	78	23	57	— 2	52	—27	133
	60		64		50		32		21		12	46	—10	
98	60	98	56	94	52	88	48	84	26	78	24			
95	65	96	66	90	57	87	52	83	34	79	32	72	26	77
98	64	98	58	94	54	92	51	87	29	79	29	73	21	79
						88	60	86	49	78	43	70	38	
98	60	100	64			89	44			75	35	*68	*25	
98	62	99	64	97	61	96	50	92	35	85	27	78	20	79
95	66	92	65	90	61	88	53	84	37	79	32	73	24	72
		104	66	100	58	94	52							
104	61	106	62	100	58	95	50	88	33	80	29			
98	50	100	64	96	49	90	50	90	30	80	28			
98	65	101	68	96	64	92	52	88	36	83	31	74	24	80
						88	49	86	31	80	29	73	25	
95	65	97	65	93	61	91	53	87	40			78	28	
96	66	98	67	93	64	89	54	85	41	80	37	69	27	
99	61	96	70	94	60	91	57	91	41	83	35	78	31	
95	64	97	64	95	63	93	47	89	35	84	28			
92	58	96	53	90	56	86	52	84	30	74	32			
94	65	96	68	90	62	86	52	84	34	78	34	66	23	78
98	60	100	61	93	56	89	46	86	30	76	30			
98	60	100	64	94	60	92	50	90	36	82	32			
94	63	97	60	93	58	88	50	85	31	82	29	75	22	77
96	61	97	60	94	53	89	50	82	30	72	24			
94	69	94	70	91	66	90	54	86	40	84	32	77	28	70
102	60	103	60	98	56	96	48	93	31	89	25	76	19	88
100	48	98	50	94	58	90	40	89	40	83	35			
96	63	97	61	92	58	90	50	87	33	79	28	72	25	78
98	68	97	71	94	66	92	54	86	37	79	36	76	30	73
91	67	92	69	92	66									
97	66	98	66	96	64	92	53	90	40	85	30			
103	62	104	60	98	54	92	50	88	30	79	26			
95	68	96	65	92	50	89	51	86	33	86	31	76	25	76
90	74	93	73	91	66	89	57	85	48	83	42	78	34	63
94	64	95	58	90	54	87	52	83	31	78	29	70	22	77
95	61	99	64	96	59	94	52	89	32	86	26			
101	67	96	66	93	62	90	54	86	31	79	31	70	28	
												*70		
94	66	100	62	93	60	90	50	88	29	81	29	74	20	83
103	63	104	57	101	58	98	51	95	30	88	26	81	20	
94	66	99	68	93	65	91	53	88	38	83	35	79	27	75
94	66	98	66	94	63	91	52	88	38	83	31	74	26	75

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°
Mississippi—Continued.										
Water Valley	79	24	78	26	81	19	88	46	96	46
Waynesboro[1]	78	26	84	31	82	20	85	37	88	45
Waynesboro	----	----	----	----	----	----	----	----	92	44
West Point	----	----	----	----	77	20	88	45	87	44
Missouri:										
Adrian	----	----	----	----	----	----	----	----	----	----
Appleton City	73	1	72	— 1	74	5	85	27	90	33
Austin	----	----	----	----	----	----	----	----	----	----
Bethany	60	—11	54	— 5	55	—13	71	27	86	36
Bradleyville	----	----	----	----	----	----	----	----	----	----
Brunswick	66	3	70	— 4	70	3	87	29	90	33
Carrollton	60	— 6	65	— 3	58	2	76	30	80	37
Carthage	73	5	75	— 1	75	9	84	35	84	41
Cassville	----	----	----	----	----	----	----	----	86	36
Centerville	----	7	----	5	----	— 8	----	27	92	31
Columbia	70	0	75	— 1	70	— 6	88	29	90	33
Conception	56	—19	68	— 8	71	— 3	87	24	86	31
Craig	56	—15	60	— 5	70	10	----	----	90	38
Concordia	----	----	----	----	----	----	----	----	----	----
Dadeville	----	----	----	----	----	----	----	----	----	----
Eldon	----	----	----	----	----	----	----	----	96	40
Excelsior Springs	65	— 6	71	— 3	71	— 4	85	29	90	32
Fayette	68	— 1	71	0	69	— 2	85	29	90	32
Fortescue	58	—15	67	— 9	66	— 0	88	26	89	35
Fox Creek	66	4	72	2	66	4	82	26	84	34
Frankford	62	— 1	----	— 2	----	— 4	80	30	----	----
Glasgow	70	— 3	71	— 1	68	— 3	86	28	88	34
Glenwood	----	----	----	----	----	----	----	----	----	----
Grand Pass	68	— 3	70	0	70	0	88	30	90	34
Hannibal	52	0	70	— 2	44	0	92	28	88	31
Harrisonville	60	1	72	— 1	71	4	86	30	92	40
Hermann	----	----	----	----	----	----	----	----	----	----
Ironton	76	10	80	6	74	4	88	32	86	44
Jefferson Barracks	75	7	79	4	70	1	90	26	91	31
Kansas City[2]	67	— 6	72	— 1	74	4	91	29	91	36
Kansas City[3]	68	— 5	71	0	73	5	89	30	87	36
Kidder	----	—12	----	— 6	----	----	----	----	----	----
Kidder[3]	----	----	----	----	----	----	----	----	----	----
Lamar	----	----	----	----	----	----	----	----	87	32
Lamonte	70	0	----	----	----	----	84	30	90	38
Lamonte	----	— 5	----	— 7	----	— 4	----	27	----	31
Lebanon	65	5	78	2	72	8	82	34	80	40
Liberty	62	— 6	70	— 2	72	1	92	27	94	33
McCune Station	----	----	----	----	----	----	----	----	----	----
Marshfield	71	10	----	----	----	----	88	30	----	----
Miami[4]	68	— 6	70	— 2	74	— 4	----	----	----	----
Miami[5]	72	— 8	74	— 2	68	— 2	85	28	95	32
New Frankfort	62	— 3	68	0	----	----	----	----	86	38
New Haven	70	7	70	2	74	4	88	30	92	37
Oak Ridge	76	14	75	16	77	7	83	35	95	38
Oregon	65	—16	67	7	74	— 2	92	27	85	33
Ozark	70	6	70	6	78	0	90	32	----	----
Pickering	----	----	----	----	----	----	----	----	74	26
Platt River	58	—12	68	— 4	74	— 4	86	26	86	32

[1] W. S. Davis.
[2] S. J. Spurgeon.
[3] Signal Service.
[4] Robert Ruxton.
[5] Dr. A. W. Sullivan.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
104	60	104	58	99	62	'94	54	90	31	81	30	·74	23	85
94	64	95	69	94	61	90	51	87	36	80	30	75	24	75
99	54	98	64	94	60	92	55	88	34	89	30			---
92	69	92	74	88	66	85	54	84	38	80	30	74	27	---
98	53	102	44	102	44	90	27	85	18	78	14	64	3	---
[f]100	[f]54			102	53	88	36	83	27	77	24	62	13	---
97	60	100	68	101	58	88	40	88	32	79	26	68	13	---
94	60	98	62	94	55	85	35	80	24	63	22	56	7	111
96	62	98	70	96	66			86	28					---
97	53	102	56	95	53	87	34	85	25	73	20	64	12	106
[k]95	60	99	59	94	52	87	38	80	26	75	27	61	10	105
96	54	99	66					85	31	77	29	62	3	---
95	50	98	53	96	50	88	35	[g]82	[g]23	[d]75	[d]23	66	— 3	---
97	45	97	42	94	41	90	35	83	16	[d]68	16	64	— 2	---
100	48	104	54	99	47	90	34	88	22	80	23	65	7	110
95	52	100	56	96	49	88	36	80	22	68	20	64	6	119
99	60													---
		107	78	102	72	90	60	86	54	74	42	62	28	---
				98	64	88	45	85	35	78	31	68	20	---
106	58	108	58	100	56	90	40	90	30	80	28	66	18	---
100	45	103	58	101	53	88	32	81	20	72	20	64	6	109
100	51	104	50	98	52	90	36	86	22	80	22	64	2	106
95	54	102	58	96	54	89	41	72	24	72	22	70	2	117
95	58	96	56	94	50	92	40	84	24	74	28	64	14	96
97	52	103	55	98	52	89	36	85	25	79	22	63	9	106
[g]97	[g]44	108	54	101	41	89	[h]32			74	24			---
96	55	102	55	95	52	90	37	84	28	76	24	60	9	105
98	54					91	38	90	26	74	26	60	14	---
96	58	99	66	96	58	86	38	80	25	70	22	61	13	100
				95	57	90	43	85	27	70	28	55	12	---
95	62	94	62	92	56	88	45	87	24					---
100	52	101	50	99	47	92	38	89	24	78	25	65	8	100
100	50	104	58	100	53	90	36	88	26	78	24	67	13	110
97	55	102	59	97	56	87	39	82	30	75	24	68	14	107
		106	59	96	54		38		[e]24		28			---
91	67	98	68	87	63	81	55	73	51	70	44	66	35	---
100	50	101	54	98	56	88	31	89	27					---
104	60							90	34	80	28	65	11	---
	60		60		53		33		22		22		10	---
94	60	94	64	92	62	86	40	80	28	76	30	76	30	92
103	49	105	54			90	32	82	24	74	21	64	9	---
		93	71	90	70	85	76			68	62	56	23	---
97	58			93	59	89	45			76	33			---
		102	62	[e]96	56	90	34							---
105	50	106	58	100	54	90	34	86	26	74	24	65	14	114
97	58	101	62	92	57	85	40	84	28					---
101	62	103	66	102	57	95	43	90	26	86	26	62	14	101
103	60	102	57	99	52	96	45	84	30	[d]76	30	65	18	96
96	50	103	56	96	52	92	35	78	27	73	21	70	6	119
92	50	110	55	84	48	74	30	70	19	61	14	54	— 1	---
96	46	100	56	96	52	92	32	80	24	64	30	60	8	112

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°
Missouri—Continued.										
Princeton	60	—10	60	— 4	72	—11	90	27	91	32
St. Charles[1]	61	5	76	2	70	4	85	27	86	30
St. Louis[2]	74	8	78	4	69	6	89	30	90	37
Sarcoxie	----	----	----	----	----	----	----	----	85	33
Sedalia	72	— 3	70	— 4	73	— 2	86	27	90	35
Springfield[2]	74	4	76	— 2	75	6	88	32	88	36
Steelville	72	8	78	3	71	— 2	88	32	----	----
Stellada	----	----	----	----	----	----	----	----	----	46
Warrensburg	66	— 3	60	— 2	70	3	86	30	[a]84	39
Warrenton	----	5	----	5	----	0	----	37	85	46
Willow Springs	75	8	81	2	79	4	92	32	97	34
Windsor	60	8	62	6	58	9	80	38	80	48
Withers Mill	65	2	70	0	68	0	76	22	88	40
Montana:										
Blackfeet Agency	----	----	----	----	[e]56	—[e]4	[e]79	[e]7	----	26
Camp Poplar River	38	—39	45	—46	52[4]	—22	83	16	86	22
Choteau	----	----	----	----	----	----	----	----	----	----
Fort Assinaboine[3]	45	—38	42	—40	52	— 7	82	12	85	31
Fort Assinaboine[2]	46	—39	50	—40	52	— 7	79	17	80	30
Fort Custer[3]	45	—32	64	—34	65	— 4	80	17	88	30
Fort Custer[2]	45	—32	64	—34	65	— 4	80	17	88	30
Fort Keogh	45	—38	52	—47	66	— 1	84	15	93	19
Fort Logan	48	—40	52	—40	58	—10	77	0	78	25
Fort Maginnis	56	—31	59	—43	52	7	80	15	81	29
Fort Maginnis[2]	49	—38	60	—43	52	4	74	12	74	27
Fort Missoula	40	—18	42	—18	54	12	80	18	85	34
Fort Shaw	52	—29	56	—39	67	12	83	16	83	32
Glendive	44	—36	50	—44	69	—15	89	19	94	26
Helena	49	—23	57	—29	59	4	78	20	82	32
Martinsdale	45	—42	48	—42	53	— 8	82	11	82	30
Powder River	48	—35	50	—41	69	20	84	15	97	21
Sheldon	46	—24	48	—38	58	2	88	26	86	42
Virginia City	43	—27	50	—24	57	2	73	15	78	29
Mexico:										
Guanajuato	75	38	----	----	84	32	84	45	30	8
La Logia	82	41	86	43	90	47	90	45	98	58
Leon de Aldemas	77	41	81	39	84	36	88	50	93	55
Mazatlan	78	61	77	61	77	61	81	65	85	73
Mexico	70	40	79	34	81	38	82	48	82	48
Pueblo	71	37	----	----	77	40	84	47	86	47
Topolobampo	----	----	79	57	82	60	81	63	----	----
Zacatecas	75	31	80	23	82	34	84	40	87	46
Nebraska:										
Alliance	----	----	----	----	----	----	82	17	94	26
Ansley	69	—24	70	—26	72	0	84	9	94	20
Ashland	50	—20	63	—14	----	----	87	38	91	29
Bassett	----	----	----	----	----	----	86	28	90	34
Beavor City	----	----	----	----	----	----	----	----	----	----
Bingham	57	—18	58	—19	64	3	80	12	----	----
Creighton	56	—27	58	—23	61	— 4	85	11	92	23
Crete[4]	57	—18	68	—14	67	3	89	20	88	28
Crete[2]	57	—18	68	—14	67	3	89	20	88	28
Culbertson[6]	----	----	----	----	----	----	88	32	98	36

[1] L. C. Saeger.
[2] Signal Service.
[3] U. S. Post Surgeon.
[4] G. A. Gilbert and C. F. Chadsey.
[6] Mrs. L. A. Wibley.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
103	51	106	59	106	51	90	34	85	24	70	23	65	8	117
91	51	99	50	97	48	90	37	88	24	79	25	60	12	97
98	57	98	57	97	54	92	41	89	29	76	32	63	17	94
95	50	98	54	95	53	89	39	84	27	76	26	65	—2	---
99	53	102	57	100	44	89	37	86	36	78	24	60	11	106
96	54	95	59	94	56	87	38	84	29	78	29	64	11	98
-----	-----	94	52	94	49	82	40	86	20	72	20	64	—2	96
-----	60	-----	60	99	53	88	37	[d]86	26	-----	21	63	10	---
98	56	[a]105	65	[a]99	55	88	40	84	29	74	26	66	19	108
99	59	103	65	-----	-----	-----	40	-----	26	-----	29	58	16	---
105	50	95	56	94	53	90	42	84	28	75	26	61	8	103
90	60	95	60	99	53	88	37	86	26	71	21	63	10	93
98	60	103	62	99	58	84	32	86	24	78	26	60	16	103
88	35	94	40	84	38	80	10	69	22	67	4	54	—3	---
91	38	99	43	99	34	92	29	86	21	65	8	57	—4	145
93	36	97	40	91	38	85	24	78	21	72	4	61	2	---
97	39	99	43	94	44	86	26	71	22	68	0	56	—12	139
96	40	99	44	94	40	87	26	71	22	68	0	56	—12	139
91	40	100	48	96	39	88	29	88	24	74	10	58	—7	134
91	40	100	48	96	39	88	29	74	24	74	10	58	—7	134
95	39	105	41	102	34	98	29	94	18	72	8	64	—19	152
86	30	94	35	89	33	82	17	67	11	-----	-----	-----	-----	---
[h]85	[h]36	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
86	30	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
90	33	104	38	93	40	87	25	70	20	60	10	51	7	122
190	41	101	43	92	40	88	24	79	24	72	8	58	0	140
04	37	105	50	106	41	96	31	82	26	68	14	60	—1	150
91	40	96	48	91	45	84	26	69	26	66	9	54	2	125
92	32	102	33	94	40	80	30	70	20	66	5	49	9	144
91	41	107	44	101	39	93	26	75	19	69	.5	57	—15	148
92	44	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
86	32	92	30	88	40	78	23	67	16	59	4	46	5	119
-----	-----	81	57	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
102	65	102	78	98	80	100	76	96	60	96	52	-----	-----	---
92	56	87	55	83	55	80	48	81	47	77	41	72	34	59
89	76	88	76	90	75	90	77	89	74	86	70	-----	-----	---
83	51	78	50	76	51	72	46	-----	-----	72	39	-----	-----	---
83	50	82	46	81	50	-----	-----	-----	-----	81	37	-----	-----	---
-----	-----	-----	-----	90	80	92	78	90	73	88	64	-----	-----	---
89	41	83	43	78	46	77	41	81	33	74	30	73	28	66
105	32	105	41	102	37	93	20	79	8	74	4	67	—3	---
108	38	109	47	106	39	97	24	81	20	79	6	74	—4	135
100	46	104	52	100	48	94	30	79	21	68	18	69	4	---
98	53	106	58	95	52	100	31	82	22	72	12	70	—5	---
-----	-----	-----	-----	-----	-----	102	37	88	22	72	16	[k]82	[k]2	---
98	36	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
-----	-----	105	49	103	38	101	28	72	20	66	7	59	—2	---
74	-----	103	52	100	45	96	31	82	25	71	16	74	5	121
98	44	103	52	100	45	96	31	82	25	71	16	74	5	121
105	63	110	61	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Nebraska—Continued.	°	°	°	°	°	°	°	°	°	°
David City	60	—23	60	—24	62	— 6	82	10	90	32
De Soto	49	—19	64	—11	64	— 2	87	21	92	32
Ericson										
Fairbury	56	—12	63	— 6	69	10	90	43	93	32
Fairfield	55	—16			68	6	87	25	88	31
Fort Niobrara	58	—34	65	—29	71	—22	86	7	93	24
Fort Omaha	54	—12	65	— 8	70	4	82	21	90	32
Fort Robinson	63	—20	72	—23	70	4	81	18	90	27
Fort Sidney	58	—13	70	—12	75	3	80	18	93	28
Franklin	59	—22	74	—19	72	9	86	18	91	25
Fremont	51	—19	60	—15	62	— 7	83	19	90	32
Genoa	50	—21	60	—24	64	1	84	19	90	30
Gering			70	—18	71	11	80	21	89	30
Grand Island				—12	62	2	72	20		
Hastings										
Hay Springs	54	—19	62	—21	71	— 1	82	16	91	28
Hebron							93	23	92	30
Holdrege										
Howe	50	—19	60	—12	70	4	90	23	84	34
Imperial										
Kennedy	62	—16	70	—16	75	10	f81	f20	96	
Kimball	57	—10	69	—18	73	3	81	17	93	28
Lexington	60	—15	70	—15	67	0			87	32
Lincoln	53	—16	67	—11	66	— 6	89	21	88	35
Long Pine									100	20
Marquette	53	—17	67	—15	72	— 2	92	24	98	36
Minden	56	—18	58	—20	70	— 2			90	26
Nebraska City	52	—19	60	—11	69	2	86	32	85	34
North Loup	56	—24	58	—28	64	— 1	84	29	94	21
North Platte	66	—12	69	—16	73	4	85	20	92	28
Omaha	52	—14	64	—12	65	1	86	23	89	33
Oakdale	59	—29	62	— 8	64	— 4	86	17	92	28
O'Neill										
Palmer	52	—16	64	—24	64	0	82	24	92	28
Ravenna	61	—21	68	—22	69	2	88	16	90	24
Syracuse	56	—14	64	— 8	66	6	85	27	89	41
Tecumseh	52	—18	56	—12	g63	—g4	90	30	86	30
Tekamah					63	16	83	16	80	32
Thedford										
Valentine	59	—24	66	—22	69	— 3	83	17	91	26
Wallace										
Weeping Water	54	—23	65	—15	65	2	87	18	91	26
West Hill	54	—11	59	—24	63	— 4	88	28	89	36
Weston	58	—17	70	—10	72	5	89	29	90	35
West Point	50	—23	62	— 8	62	7	80	32	85	41
Whitman										
Wilcox							94		99	28
Nevada:										
Austin	49	—11	55	—12	57	7	73	17	82	23
Battle Mountain	42	—18	60	—12	64	22	77	40		
Belmont	38	— 4	55	— 9	53	10			79	30
Beowawe	42	—32	60	—20	67	14	80	33	85	43
Browns	50	—18	63	— 4	70	14	86	38	92	50
Candelaria	40	— 4	58	4	61	18	73	27	82	31
Carlin	38	—50	55	—34	58	2	74	28	87	40

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
92	46	103	58	96	48	88	28					64	2	---
96	52	102	55	97	48	95	33	73	24	67	19	65	4	121
						94	36	78	25	76	9	70	5	---
96		104		98		93	32		30			57		---
98	48	107	54	100	49	94	32	78	26	73	16	70	4	---
100	35	108	40	101	34	96	18	83	12	78	— 8	70	—10	142
98	50	101	55	96	49	93	31	77	23	72	19	71	10	113
99	36	102	51	100	36	93	27	80	19		10	68	5	---
99	35	103	50	100	43	94	30	77	25	73		65	[m]5	116
								82	29	72	14	67	4	---
95	50	103	54	96	48	91	31	73	23	68	18	70	5	122
98	50	106	56	104	50	93	32	75	25	70	11	65	3	130
99	36	103	55	99	43	92	32	78	23	73	16	65	8	---
		98	60	84	54	82	32	64	24		10		0	---
				104	52	96	34	80	26	70	12	66	4	---
102	36	102	52	98	43	90	23	76	17	70	12	62	7	123
99	51	103	55	97	49	96	32	82	24	66	19	64	7	---
100	53	106	60	103	53	100	38	73	26				— 2	---
98	53	102	55	97	49	93	36	75	25	72	22	65	5	121
103	58	109	70	108	68	92	53	74	53	68	18	[n]60	[n]8	---
101	44	106	59	100	48	103	30	87	30	70	10	68	8	122
101	35	106	50	103	41	93	29	80	21	73	9	67	6	124
97	54	103	59	103	52	96	25	80	17	78	8	68	— 2	---
99	55	103	54	99	47	95	34	80	25	69	20	71	5	119
103	50	111	50	100	40	82	32	70	26		— 4	69	10	---
101	48	108	65	104	45	93	36	77	30	70	14	68	4	125
102	50	108	64	108	52	100	32	78	30	72	10	66	4	---
99	49	106	55	98	48	88	33	73	24	67	18	70	7	125
95	42	102	48	105	40	94	23	78	20	70	7	61	— 2	133
98	39	103	53	100	45	96	30	81	21	77	6	70	4	119
98	52	105	55	99	48	94	36	76	26	70	20	71	5	119
97	45	103	48	103	40	95	24	75	22	71	8	68	0	132
		104	57	100	46	95	35	85	28	79	12	80	9	---
96	52	106	70	100	52	92	25	72	20	70	6	64	— 2	130
100	40	105	52	104	40	94	24	76	22	72	10	71	2	127
101	59	106	68	100	52	94	40	75	26	67	20	67	8	120
97	56	100	60	95	46	90	32	79	21	66	13	[c]60	[c]2	118
94	55	102	53	97	55	95	30	73	24	71	13	68	2	---
108	56	112	62	102	55	106	60							---
98	44	103	54	98	44	92	27	80	19	75	1	68	1	127
						94	36	78	28	73	12	70	9	---
101	48	107	51	102	45	95	29	76	20	69	17	72	1	130
96	55	103	63	100	49	91	41	73	27	65	10	65	0	127
100	56	106	54											---
91	62	95	67	95	61	90		76	42	68		55	6	118
						90	28	90	28	72	16	64	8	---
105	43	112	53	108	43	104	33							---
85	31	93	50	87	48	78	37	69	25	62	17	54	12	105
90	50	102	67	95	60	89	50	73	35	67	18	53	13	---
83	33	93	48	90	48	81	38	69	27	66	19	54	10	---
93	42	101	60	99	56	88	30	74	20	70	10	58	10	133
95	48	104	70	102	66	94	52	78	36	70	10	58	21	122
87	35	96	53	90	51	85	41	71	25	65	22	55	18	100
90	38	110	56	101	**43**	92	32	**74**	**16**	**64**	**4**	**48**	**0**	**160**

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Novada—Continued.	°	°	°	°	°	°	°	°	°	°
Carson City[1]	52	—27	63	— 5	66	10	78	22	91	30
Carson City[2]	50	—22	59	— 3	62	12	75	24	85	32
Columbus Marsh			52	— 4	72	3	82	22	96	38
Downeyville	48	—18	57	1	69	16	79	24	88	34
El Dorado Canyon	73	30	88	32	82	40	96	46	105	55
Elko[1]			45	—26	58	— 8	80	28	83	34
Elko[2]	47	—42	58	—41	62	—15	82	10	90	28
Ely	50	—27	60	—23	60	1	62	29	85	28
Eureka	45	—26	56	—19	60	3	77	16	86	26
Fenelon	55	—27	55	—20	75	10			91	41
Genoa	50	—24	59	— 6	65	10	78	24	83	30
Golconda	48	—17	60	—14	66	26	70	30	92	36
Gold Mountain	50	8	63	6	64	19	72	29	84	29
Halleck	38	—30	43	—32	60	4	90	34	88	40
Hartons Ranch	41	—15	48	— 9	59	10	65	20	80	25
Hawthorn					68	32				
Hawthorne	52	— 6	66	6	68	18			88	46
Hot Springs	42	—20	70	— 2	60	15	80	25	95	35
Hot Springs	42	—20	70	— 2	60	15	80	25	95	35
Humboldt	49	—20	60	—15	62	4	82	28	86	40
Lewer's Ranch	49	—14	63	— 4	66	14	77	23	90	30
Mill City	48	—28			50	10				
Palisade	42	—25	52	—20	60	2	80	27	85	40
Palmetto			56	1	60	15	74	21	89	27
Pioche			66		70					
Punch Bowl					50	7	68	19	78	27
Reno[3]	49	—19	59	— 4	64	12	75	23	84	29
Reno[4]	54	—12	58	6	60	14	76	26	82	40
Ruby Hill	43	—14	46	—17	51	0	62	8	76	25
Sodaville	44	—22	62	10	70	21	80	27	92	37
Tecoma	40	—14	48	—15	60	0	78	35	89	35
Toano	42	—12	60	—18	58	0	78	24	84	42
Tuscarora	38	—18	48	—27	50	10	76	15		
Tybo										
Verdi	45	—23	55	— 7	60	15	69	33	60	33
Virginia City	44	3	53	1	58	15	73	27	84	28
Wadsworth	45	— 6	62	6	68	18	86	30	96	46
Wells	42	—25	52	20	60	4	80	25	85	35
Winnemucca[3]	40	—18	52	—18			61	23	99	32
Winnemucca[2]	48	—23	57	—22	61	7	79	20	88	32
Younts Ranch	65	18	72	20	76	26	88	38	94	42
New Hampshire:										
Berlin Falls	57	—17	48	—17	54	—19	72	10	75	22
Berlin Mills	57	—12	51	—12	48	—14	71	14	71	25
Concord	61	— 7	55	— 7	61	— 7	75	19	80	33
East Canterbury	54	— 2	50	— 7	58	— 5	68	22	76	29
Hanover[5]	58	— 9	51	— 6	50	—11	70	10	77	28
Hanover[6]	63	— 8	56	— 8	53	—14	76	11	73	29
Littleton										
Manchester	60	— 4	55	— 6	59	— 4	73	23	77	36
Manchester[3]	62	— 1	57	— 6	64	— 4	74	24	80	35
Nashua	63	— 2	59	— 4	62	— 4	75	23	82	33
Newton	62	2	58	— 5	60	— 2	74	22	85	32

[1] Chas. W. Friend.
[2] Signal Service.
[3] W. S. Devol and Wm. E. Barney.
[4] Pacific Railway System.
[5] Prof. E. B. Frost.
[6] N. H. Experiment Station.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
91	27	97	37	94	38	88	30	79	23	73	13	64	12	124
88	30	92	41	91	41	83	34	73	26	67	17	60	15	114
101	36	108	47	104	46	98	38	81	23	81	12	56	3	---
92	37	102	49	99	44	89	40	77	30	74	20	63	17	120
109	62	118	77	110	74	110	66	92	48	86	46	73	42	88
94	38	104	52	95	52	90	40			68	10	56	8	---
		107	28	103	28									
89	24	99	38	94	34	81	18	69	15	64	9	61	1	126
91	29	102	43							63		64	23	---
98	43	104	65	105	60	100	50	92	30	71	20	63	11	---
86	31	93	40	88	45	84	37	81	27			60	14	---
98	40	118	66	106	62	90	40	82	32	72	16	58	12	135
87	36	96	58	90	55	86	50							---
92	36	100	48	94	48	82	32	68	10	62	3	52	1	132
95	27	101	40											---
								79[h]	28[h]	69	25	64	21	---
98	52	99	65	99	70	89	60	75	38	65	35	53	24	124
90	45	104	60	99	60	90	47	76	28	69	15	56	11	---
90	45	103	60	99	62	90	47	76	28	69	15	56	11	123
86	40	96	56	92	50	88	44	68	30	65	15	62	12	116
90	30	95	45	92	46	86	41	76	27	72	22	62	13	109
		104	56	104	58	90	46	84	30	68	16	58	10	---
88	38	102	50	98	43	85	35	78	20	72	12	62	10	127
88	27	97	44	90	42	87	33	75	24	69	18	62	9	---
		104	33	102	29	93	24	73	8	68	5	57	0	---
81	26	93	47	94	44	82	30	64	24					---
90	30	96	42	94	44			76	27	68	18			---
99	44	100	52	96	50	89	42	80	30	66	20	52	14	112
78	24	97	40											---
96	39	104	58	100	53	94	39							---
98	38	107	50	100	50	91	40	70	20	65	18	45	8	122
87	44	97	51	96	52			72	20	67	8			---
88	27	104	35	98	36									---
		96	38	94	44	89	35	82	21	80	9			---
84	35	99	49	98	46	86	38	68	30	60	18	58	4	122
88	32					82	41	70	24	64	24	58	18	---
96	42	105	57	102	56	88	46	78	32	68	20	60	18	111
92	32	100	60	100	58	85	48	75	16	78	12	65	4	125
88	39	103	52	96	50	82	45	73	28	73	15	49	14	---
91	34	99	44	95	42	84	30	74	22	69	9	54	11	122
96	46	106	66	96	61	96	55	82	41	76	17	66	28	89
86	26	90	35	93	32	77	23	75	16	54	2	40	−31	124
87	29	90	30	93	32	79	20	76	18	55	2	40	−30	123
87	42	91	45	88	46	80	31	75	29	64	8	39	−11	102
86	42	89	53	86	50	79	38	65	30	58	10	37	−11	100
83	38	91	40	88	42	78	30	70	23	53	8	35	−20	111
88	37	94	38	91	38	85	28	79	22	64	8	44	−26	120
				84	42	78	32	73	22	55	8	38	−22	---
88	42	92	44	88	46	81	34	77	30	58	8	42	−10	102
87	42	93	42	87	46	81	33	78	28	63	11	44	−5	99
89	40	95	43	90	47	82	30	78	27	60	8	48	−2	99
88	44	94	42	88	44	82	30	76	26	62	9	48	−2	99

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
New Hampshire—Cont'd.	°	°	°	°	°	°	°	°	°	°
North Conway	61	—10	57	—10	51	— 6	70	16	77	25
North Sutton		1	55	— 6		0		27		38
Plymouth	53	— 9	51	—10	49	— 8	75	13	80	25
Stratford	56	—15	52	—15	46	—20	75	11	78	25
Walpole	60	— 5	52	— 8	52	—11	69	20	75	26
West Milan	60	—21	54	—20	56	—22	74	6	73	22
New Jersey:										
Allaire	70	14	69	17	76	8	81	29	85	35
Asbury Park	67	18	71	19	69	9	75	30	75	39
Atlantic City	64	18	71	20	63	10	80	29	76	44
Beverly	76	17	76	20	77	8	84	24	87	36
Billingsport, L. H	69	21	66	22	73	11	80	30	85	42
Bridgeton	70	23	72	24	74	14	80	34	85	47
Cape May, C. H	78	18	68	22	71	10	80	24	80	37
Egg Harbor City	76	15	72	19	75	8	81	21	83	34
Freehold	70	15	68	17	73	3	80	25	82	34
Gillette	65	14	67	14	71	6	80	25	80	35
Hanover	65	14	66	16	73	9			84	38
Highland Park	67	12	68	17	72	6	81	27	81	36
Imlaystown	68	17	68	19	78	6	80	27	83	38
Lambertville	69	20	68	22	71	8	82	31	82	49
Locktown	70	15	67	16	73	6	82	24	83	35
Madison	67	14	69	15	72	5	84	25	83	34
Moorestown	73	18	70	19	74	9	81	26	84	38
Newark[1]	64	17	66	18	68	4	80	26	80	43
New Brunswick[2]	66	21	68	20	69	12	78	32	85	33
New Brunswick[3]	70	15	67	17	71	6	81	26	81	36
New Brunswick[4]	69	16	68	17	72	6	83	25	83	34
Newton			68	12			[f]79	[f]25	75	33
Ocean City	65	18	68	24	63	12	82	32	76	46
Oceanic	69	20	67	20	73	12	79	31	87	41
Princeton	65	17	67	18	69	6	80	28	80	39
Rancocas	70	18	68	19	74	8	80	27	85	41
Readington	70	18	72	20	[e]70	[g]8	86	32	80	44
South Orange	67	15	70	16	72	6	82	25	84	37
Tenafly	65	16	59	15	73	0	84	28	86	41
Trenton	70	17	72	18	72	7	80	30	84	45
Union	65	17	68	17	68	7	80	32	80	45
Woodbury	72	22	69	22	74	13	83	29	84	40
New Mexico:										
Albuquerque	67	8	72	11	75	13			90	[n]42
Chama		—17	65	—17	64	— 4	72	11	85	27
Coolidge			67	—10	61	— 9	61	9	89	29
Deming	70	20	84	26	85	34	86	33	98	61
Fort Bayard		9	81	10	76	14	76	24	89	40
Fort Marcy	64	— 4	68	3	66	5	70	16	84	34
Fort Selden	79	15	85	15	90	15	90	33	104	45
Fort Stanton[5]	72	7	78	11	75	5	78	17	90	34
Fort Stanton[6]	69	8	76	13	75	6	75	14	85	36
Fort Union	58	10	68	4	70	— 4	74	5	84	28
Fort Wingate	64	— 3	70	—8	65	4	78	20	88	32
Gallinas Spring	75	14	80	9	74	14	78	25	89	45
Hillsboro	75	15	80	9	80	15	81	29	93	42
La Luz			78	16	85	20	90	28		

[1] F. W. Ricord.
[2] C. V. Meyers.
[3] Mrs. G. H. Cook.
[4] Prof. A. Scott.
[5] U. S. post surgeon.
[6] Signal Service.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
89	38	92	41	90	41	80	29	76	24	58	10	41	—16	108
	47		55		51		42		34				7	---
89	34	96	38	94	38	84	26	74	21	54	8	39	—16	112
90	33	93	40	92	38	85	25	82	21	61	8	36	—25	118
85	38	90	40	88	42	80	30	72	25	65	9	42	—15	105
82	30	88	36	90	34	80	25	75	12	59	4	40	—32	122
90	45	93	44	90	43	86	40	72	31	70	15	54	9	85
91	51	92	51	88	45	88	46	73	30	63	18	52	14	83
90	54	89	52	90	48	78	48	74	35	70	18	54	17	80
90	52	100	39	99	45	88	41	81	28	74	19	53	8	92
94	58	99	56	94	52	88	48	74	34	66	24	48	17	88
93	60	96	58	93	56	88	47	77	35	72	24	56	22	82
91	50	96	50	89	48	86	43	78	33	71	17	55	16	86
94	50	97	45	96	44	87	38	74	27	73	15	56	14	89
89	50	94	47	89	46	86	38	74	30	69	28	54	11	91
90	42	95	43	91	45	86	33	75	25	70	16	47	10	89
88	51	94	49	88	48	86	37	72	28	63	17	50	5	89
95	51	97	48	92	45	88	33	75	32	71	18	54	13	91
90	56	94	54	86	52	85	38	74	29	62	22	51	12	86
92	50	98	47	91	45	88	37	75	28	70	18	49	5	93
91	47	95	39			89	33	76	26	70	16	50	5	---
91	56	97	51	92	52	85	42	79	33	71	20	51	14	88
90	57	94	55	88	50	84	46	72	32	60	17	48	13	90
92	47	98	45	92	45	88	37	73	27	70	16	50	7	91
87	50	93	48	87	49	85	40	72	29	70	18	50	9	87
89	49	94	48	88	48			78	28	70	17	51	11	---
87	49	91	44	87	40	83	33	71	27	59	16			---
90	56	90	60	89	61	80	54	74	41	67	19	48	18	78
		95	38	89	51	90	50	76	34	67	23	53	16	---
								73	33	68	19			---
90	56	97	53	92	51	88	43		32	67	28			---
88	58	96	58	90	54	[f]84	[f]44	[f]72	[f]34	70	20	50	16	88
89	51	94	50	89	48	85	40	72	31	70	18	49	8	88
93	56	97	40	91	43	88	33	73	24	64	18	49	3	97
90	60	97	58	93	51	84	45	78	40	72	22	54	16	90
87	57													
[g]95	[g]56	101	53	94	50	91	44	78	34	70	24	52	18	88
[g]97	[g]45	[j]97	[j]50	94	57	91	46	77						---
92	23	97	41	94	43	89	31	81	17	78	12	62	— 2	114
93	35	101	35	92	31			83	19	82	19	53	13	---
102	60	100	66	98	65	95	60	80	45	76	29			---
90	43	94	52	87	48	87	44	81	31	78	18	77	21	85
90	33	92	47	89	43	87	39	73	23	67	12	55	10	96
104	46	107	59	106	60	100	50							---
94	37	92	52	90	48	89	41	76	23	71	11	62	12	89
90	39	90	51	85	50	84	42	75	24	69	12	62	15	84
89	54	91	40	94	43	95	28	75	21	70	2	62	5	99
91	30	98	51	95	45	89	39	75	22	72	14	61.	10	106
93	48	94	56	92	60	98	49	82	34	75	24	65	21	89
97	45	96	56	91	57	87	48	78	34	74	19	63	23	88
								81	38	76	25			---

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°
New Mexico—Cont'd.										
Lava	72	11	75	11	82	14	86	27	92	44
Lordsburg	73	18	74	13	81	25	86	33	97	60
Los Lunas	73	21	76	23	80	19	88	38	97	48
Red Cañon	----	----	74	10	77	10	80	20	----	----
Roswell	59	11	61	9	72	11	74	28	83	45
Santa Fé	58	2	67	6	62	9	67	17	80	37
Tequesquite (Albert)	----	----	----	----	----	----	----	----	----	----
New York:										
Addison	----	----	----	----	----	----	----	----	----	----
Adelphi Academy	66	21	----	----	66	10	†76	†33	----	----
Alabama	----	----	----	----	----	----	----	----	83	28
Albany	61	6	60	4	67	— 4	79	25	78	34
Alfred Center	60	4	60	6	57	— 6	72	15	79	24
Angelica	61	4	58	5	60	—14	75	15	77	23
Arcade	----	----	----	----	----	----	----	----	----	27
Ardenia	62	17	66	13	65	5	76	32	79	43
Auburn	----	----	----	----	----	----	----	----	----	----
Binghamton	----	----	----	----	----	----	----	----	----	----
Boyds Corners	62	14	64	10	67	1	80	31	81	42
Brookfield	63	— 2	53	— 9	58	—13	73	11	74	25
Brockport	----	----	----	----	58	10	78	24	82	30
Buffalo	65	10	60	13	54	8	66	26	79	34
Canton	60	—14	51	—13	50	— 4	71	14	81	26
Carmel	62	10	64	8	67	0	77	25	80	31
Central Park	64	15	68	16	71	7	79	29	81	41
Constableville	55	— 7	50	— 6	51	—14	72	8	74	22
Cooperstown	62	4	56	— 4	61	—15	70	18	75	20
Davids Island	65	14	69	14	68	4	81	25	81	38
Eden	65	10	63	9	60	— 2	74	24	78	31
Elmira	63	10	58	10	56	— 3	79	22	75	33
Factoryville	62	9	66	7	59	— 8	78	19	79	26
Fleming	61	10	60	6	59	3	77	19	77	23
Fort Columbus	64	16	65	18	68	8	82	29	80	40
Fort Hamilton	65	12	68	11	67	7	82	30	80	43
Fort Niagara	65	15	58	15	57	7	73	27	80	32
Fort Porter	60	10	53	14	49	10	66	28	76	38
Fort Schuyler	66	15	66	6	65	3	79	27	79	40
Fort Wadsworth	68	16	69	17	74	7	84	28	84	40
Geneva	67	10	54	8	59	3	84	22	85	28
Hammondsport	----	----	----	----	----	----	----	----	----	----
Hess Road Station	50	2	58	9	54	5	72	21	82	27
Honeymead Brook	60	14	60	4	65	— 3	76	25	83	29
Humphrey	62	3	64	10	57	— 4	78	17	77	27
Hyndsville	----	----	----	----	----	----	----	----	----	----
Ilion	65	5	59	0	60	—10	77	24	78	20
Ithaca	64	8	61	7	64	— 3	78	21	80	28
Keene Valley	59	— 9	60	— 7	60	— 3	76	11	76	24
Kendall	66	11	63	11	63	8	----	----	85	32
Kingston (Rondout)	65	10	62	5	70	0	80	18	----	----
Le Roy	----	----	56	7	55	0	----	----	----	----
Lowville	60	— 4	49	— 2	56	— 7	73	17	77	36
Lyons	67	11	62	11	57	6	76	26	73	36
Madison Barracks	58	—10	49	—19	48	— 5	----	----	77	28
Malone	----	----	51	0	----	----	67	20	----	----
Marshland	66	4	60	7	63	— 9	73	17	78	23
Middleburgh	68	8	61	0	70	—11	78	23	83	31

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°		°	°
98	50	104	62	100	59	96	50	86	30	...	...	...	...	...
98	65	102	68	96	68	92	59	82	34	74	22	66	26	89
98	49	100	57	98	54	...	...	74	28	...	...	74	12	...
103	35	104	54	98	53	92	45	77	28	71	20	57	20	...
86	49	86	60	84	63	...	47	...	...	...	...	...	...	...
86	36	90	48	88	47	82	42	72	29	65	18	52	15	88
100	48	100	59	90	62	92	47	81	33	76	29	67	17	...
...	...	...	...	...	...	90	34	78	28	65	16	44	—5	...
84	55	...	...	...	...	84	46	73	39	...	...	48	14	...
92	40	92	45	95	43	87	30	75	29	...	...	40	—2	...
89	46	98	48	91	50	82	36	76	34	59	14	46	—2	102
85	41	90	39	89	43	84	29	74	28	63	12	42	—4	96
87	36	91	35	90	38	84	27	...	...	...	...	41	—11	...
85	34	88	37	91	42	84	29	73	27	64	12	40	1	...
87	56	93	54	88	53	82	39	73	35	59	21	46	0	93
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	[1]93	[1]40	91	41	87	29	75	28	66	16	...	—7	...
93	56	97	45	92	52	87	44	77	29	65	18	45	2	96
87	38	92	36	89	38	83	25	73	26	61	3	36	—15	107
94	44	94	49	94	47	88	37	74	31	68	18	45	5	...
89	46	89	49	86	48	82	37	75	34	62	21	44	7	82
89	40	91	43	96	38	84	29	75	28	68	8	39	—16	110
88	47	92	45	91	43	85	33	...	...	...	...	...	...	...
90	54	98	55	91	52	88	45	75	37	69	19	47	—13	91
88	31	88	42	88	42	81	27	78	29	61	5	...	...	...
85	41	88	42	88	42	80	29	70	29	63	8	39	—6	103
90	52	93	52	88	47	84	41	74	31	70	11	47	10	89
97	42	95	47	95	46	...	...	...	...	...	...	...	...	...
87	51	93	49	92	52	89	37	72	34	...	...	...	...	...
84	40	94	40	87	44	82	32	78	26	63	13	46	—15	109
87	44	96	45	92	43	88	30	75	31	64	11	41	3	93
91	53	91	55	89	52	86	48	76	36	70	20	48	13	83
88	53	91	53	85	51	79	44	73	35	69	20	50	15	84
86	44	94	53	97	50	87	37	70	35	63	24	46	10	90
86	47	89	51	86	48	82	35	76	34	62	25	...	...	...
88	54	90	54	86	49	83	46	74	36	69	16	49	6	87
93	48	97	50	94	48	87	44	79	31	70	19	49	7	90
91	45	98	44	99	43	86	33	76	31	66	19	50	0	99
...	...	...	...	92	45	84	32	72	30	66	13	42	—2	...
86	45	92	44	97	42	86	31	74	30	64	18	41	2	99
85	43	92	43	86	46	83	32	71	29	62	14	42	—7	99
87	36	89	39	92	40	88	32	79	30	...	...	48	5	...
...	...	93	41	94	33	89	24	73	24	...	...	...	...	...
90	42	95	42	92	45	86	30	75	28	...	...	...	...	...
88	48	96	44	92	46	85	32	73	31	66	18	46	3	99
89	38	96	40	94	34	89	24	81	28	59	7	40	—17	113
96	32	100	48	...	...	...	...	...	...	...	...	...	...	...
95	40	100	36	97	40	...	...	79	25	60	16	44	—2	...
88	46	78	44	96	42	88	32	72	28	63	14	44	4	...
...	...	...	...	...	...	...	...	61	32	54	6	36	—10	...
86	46	92	50	94	51	84	36	72	33	63	22	42	5	89
85	44	90	50	100	43	83	30	77	26	57	7	41	—18	...
...	...	...	...	...	...	...	...	...	...	61	8	39	—14	...
89	37	94	32	100	37	84	32	75	24	67	14	46	—7	109
92	41	96	43	94	44	86	29	85	28	71	6	40	—4	107

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
New York—Continued.	°	°	°	°	°	°	°	°	°	°
Middletown			61	11	64	5	76	26	78	35
Mount Morris										
New Lisbon				0	58	—17	75	6	75	29
New York City	67	15	69	17	71	6	81	30	80	42
North Hammond	56	— 6	48	— 5	52	— 2	70	21	76	32
Number Four	54	—10	50	—16	50	—17	71	8	74	24
Ogdensburgh	56	—16	45	—16	48	— 8	69	17	80	27
Oswego	64	0	60	5	57	2	74	28	77	33
Oxford	60	4	55	20	57	—14	71	15		
Palermo	55	5	50	4	55	— 5	75	23	77	28
Palmyra	60	15	57	10	62	10	81	30	81	40
Peekskill	[h]66	[h]13	66	12	72	2	78	25	80	23
Pendleton Center	54	12	54	15	53	0	73	21	82	28
Perry City	62	9	54	1	62	— 8	76	19	76	24
Plattsburg	62	—12	52	— 4	52	— 2	68	22	73	28
Plattsburg Barracks	64	—15	56	— 5	53	6	70	22	70	23
Port Jervis	62	10			64	— 1	81	19	80	31
Potsdam	54	—14	47	— 9	50	— 2	69	24	79	21
Poughkeepsie					70	— 4	80	18	80	33
Quaker Street	64	3	57	— 2	63	— 7	75	20	74	29
Queensbury	46	4		— 6	55	—21	79	14	81	24
Rochester	66	10	65	11	57	7	78	24	78	30
Rome	64	0	54	0	62	—14	72	18	76	30
Setauket	64	18	64	16	69	8	72	30	77	41
Sherman			59	11	56	—16	72	5	78	30
South Canisteo	62	5	61	6	63	— 6	76	14	79	23
South Kortright		9		2	64	—20	76	17	76	25
Turin	54	— 6	49	— 6	49	—13	74	13	75	32
Utica	63	2	58	0	58	—10	78	22	77	28
Watervleit Arsenal	61	6	58	2	65	— 8	78	23	78	35
Wedgewood	60	3	57	1	66	1	80	12	78	24
West Point	69	10	64	10	68	— 1	83	22	80	35
White Plains	64	10	64	12	66	4	78	24	76	42
Willets Point	67	— 2	68	18	69	6	73	29	82	39
North Carolina:										
Asheville[1]	71	16	73	22	72	11	85	31	83	36
Chapel Hill	77	23	[c]78	[c]29	77	19	88	29	96	44
Charlotte	77	25	79	28	76	19	86	36	90	42
Clear Creek	80	22	80	29	78	15	86	30	88	38
Douglas	75	19	77	20	77	13	87	25	95	35
Fayetteville										
Franklin	74	12	73	17	75	11	84	28	86	28
Goldsboro									91	47
Hatteras	73	32	73	39	72	26	74	44	80	53
Highland	63	11	67	11	68	4			78	26
Hot Springs	73	18	78	26	76	18	84	33	86	41
Kitty Hawk			[f]80	[f]31	[c]81	[c]21	83	37	[b]91	[b]48
Lenoir	72	20	72	26	70	19	80	33	83	39
Lumberton									92	42
Marion										
Morganton			72	23			76	32	82	40
Mount Airy	74	18	74	19	74	18	85	29	88	34
Mount Pleasant	76	22	79	28	75	18	86	30	90	39
New Berne	78	26	80	36	82	19	86	32	88	44

[1]Dr. Karl von Ruck.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		Range.
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
86	47	94	48	86	45	81	34	72	28	62	16	42	4	---
		94	44	94	44	86	33	74	32	67	18	45	3	---
82	48	92	44	87	42	79	27	73	27	60	10	39	—12	---
89	55	95	56	89	51	86	46	74	38	71	18	54	13	89
88	49	87	53	90	45					65	18	44	— 9	---
81	37	86	34	87	39	78	27	71	27			34	—15	---
90	44	90	48	93	46	80	32	70	29	62	8	34	—16	109
86	45	93	51	92	50	84	36	71	33	64	18	42	1	93
85	41	89	39	86	40	80	30	68	28	60	12	38	— 7	---
86	41	90	44	94	45	83	31	72	29	66	11	43	— 6	100
89	50	96	56	97	50	89	37	72	32	65	20	41	4	93
89	36	93	46	86	47	89	35	74	32	66		48	8	91
89	39	90	44	93	42	85	32	75	30	64	16	42	1	93
86	45	97	39	92	41	83	28	70	27	62	15	40	— 5	105
82	44	92	49	87	45	79	35					42	— 9	---
82	42			92	43	86	33	70	28	58	8	43	—12	---
89	44	92	44	90	44	81	32	71	25	60	16	43	0	---
84	38	88	44	93	40	82	29	74	29			40	—10	---
89	40	98	40	90	44	84	30	76	27	63	12	45	— 8	---
83	46	90	46	89	46	78	30	71	28	59	6	45	— 5	97
		100	40	96	38									---
89	44	94	47	95	47	87	35	76	33	68	21	45	6	89
88	40	93	42	92	48	82	30	72	30	64	4	40	— 7	107
87	50	91	53	85	53	81	43	72	28	67	20	54	11	83
86	30			[e]88	[e]43			67	27			41	5	---
89	36	93	37	92	37	86	28	72	26	66	13	45	— 7	100
87	36	98	35		36		27	71	25	62	10	43	—13	---
84	43	90	51	91	47	82	31	68	32	61	8	37	—12	104
88	41	94	45	95	47	84	22			66	2	41	— 6	---
88	44	97	46	90	47	81	32	74	30	59	15		— 5	105
90	40	98	44	94	44	88	31	76	26	67	14	43	1	97
93	45	98	45	96	45	86	35	65	30	55	20	40	0	99
87	60	88	56	82	57	80	42	70	34	66	20	47	10	84
86	53	92	54	87	50	85	47	73	33	70	18	49	10	94
90	53	88	56	86	47	86	49	80	30	81	22	69	16	79
[e]102	59					94	52	89	32	85	26	[f]71	20	---
98	64	96	57	92	57	91	50	86	32	78	29	68	24	79
97	60	97	52	89	50	87	52	84	32					---
101	47	98	54	95	45	91	48			78	19	67	18	---
[g]101	[g]62	100	54	95	51	90	54							---
93	40	90	49	88	41	88	45	82	22	79	12	66	10	83
98	60	98	57.	94	58	91	55	88	34	78	26			---
90	67	85	65	84	65	84	67	81	44	72	38	67	31	64
84	46	82	50	80	40	76	44	72	21	72	14	62	11	---
93	54	93	61	86	50	87	43	81	30	79	25			---
[c]96	[c]63	[f]96	[f]65	98	64	92	62	[b]88	[b]40	72	33	[e]67	[e]28	---
90	60	90	60	82	52	86	53	79	30	74	23	62	18	72
99	58	96	55	94	53	95	54	88	33	76	24			---
[c]97		97	48	92	45	94	49	86	26	83	21	67	16	---
94	60	94	60	89	52	86	51	83	31	80	19	69	17	---
95	42	95	47	90	44	88	44	82	24	76	16	62	14	81
98	60	95	52	91	50	90	52	84	30	80	21	68	18	80
96	58	94	68	98	54	90	54	84	34	78	30			---

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
North Carolina—Cont'd.	°	°	°	°	°	°	°	°	°	°
Oak Ridge	72	19	73	24	72	16	84	29	92	40
Pittsboro	78	20	76	29	76	18	86	30	85	41
Raleigh[1]	80	26	80	32	79	22	88	35	92	50
Raleigh[2]	76	23	80	29	79	20	86	31	92	44
Salisbury	73	26	74	29	74	24	81	37	89	51
Smithfield	----	----	----	----	----	----	----	----	----	----
Soapstone Mount	----	22	----	28	----	18	----	30	----	42
Southport	70	29	75	30	71	21	75	38	84	48
Wadesboro	----	----	----	----	----	----	----	----	90	42
Washington	79	18	81	33	79	28	88	42	89	54
Weldon	75	22	78	23	78	20	85	28	87	42
Willeyton	75	20	80	25	81	17	86	26	86	41
Wilmington	80	27	80	32	77	22	86	38	90	50
Winslow	79	23	81	26	79	19	88	30	91	41
North Dakota:										
Bismarck	39	—35	46	—34	52	—24	82	19	83	27
Davenport	41	—30	41	—25	45	—28	83	15	89	16
Fort A. Lincoln	41	—31	48	—34	51	—30	83	11	80	26
Fort Buford[3]	40	—37	40	—33	50	—18	83	19	86	22
Fort Buford[2]	42	—37	49	—43	51	—18	82	20	83	24
Fort Pembina	35	—37	33	—46	47	—30	77	10	83	12
Fort Totten	35	—36	40	—37	40	—26	79	7	75	21
Fort Yates[3]	46	—30	54	—28	56	—19	85	15	86	27
Fort Yates[2]	57	—28	54	—26	58	—16	86	12	87	27
Gallatin	32	—40	40	—42	44	—36	82	14	84	24
Grand Forks	----	----	----	----	----	----	82	18	81	16
Kelso	----	----	----	----	----	----	----	----	----	----
Napoleon	40	—30	42	—32	49	—24	82	14	----	----
New England City	42	—36	48	—43	60	—19	87	15	87	16
Steele	44	—35	40	—41	48	—26	88	3	86	18
Wahpeton	47	—31	52	—26	55	—26	88	22	88	19
Wild Rice	----	----	----	----	----	----	----	----	----	----
Ohio:										
Akron	65	7	64	13	59	4	74	24	83	32
Ashland	65	4	66	17	60	4	77	29	83	39
Athens	70	10	70	16	67	— 1	80	23	86	30
Bangorville	64	2	64	10	60	2	74	24	84	30
Bellevue	66	6	64	8	58	4	75	26	88	36
Bement	67	10	65	18	60	3	78	21	89	28
Bucyrus	----	----	----	----	60	3	76	24	94	30
Canton	66	6	65	14	62	0	74	24	84	30
Carrollton	62	8	----	19	----	8	----	31	----	40
Celina	69	8	67	14	63	5	78	29	86	36
Cincinnati	71	10	70	18	67	7	80	31	89	39
Clarksville	67	6	68	18	63	3	76	28	85	33
Cleveland[2]	68	10	65	15	62	6	76	26	82	32
Cleveland[4]	69	10	65	15	62	6	76	26	82	32
College Hill	66	9	69	19	78	5	76	30	88	40
Columbus	67	9	66	17	62	7	75	28	86	35
Columbus Barracks	68	7	67	16	64	4	77	26	88	32
Dayton	68	6	68	16	64	3	76	28	88	34
Demos	70	8	64	16	64	0	74	26	83	33
Elyria	68	9	68	16	60	3	78	24	87	32
Findlay	67	4	66	10	60	2	76	20	85	31

[1] T. C. Harris. [2] Signal Service. [3] U. S. post surgeon. [4] G. A. Hyde.

ANNUAL RANGE OF TEMPERATURE, FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
---	---	---	---	[m]89	[l]46	88	47	82	29	77	25	62	18	---
95	58	93	52	93	51	88	51	82	34	75	22	66	19	77
98	68	95	58	92	58	91	54	88	35	---	---	67	24	---
97	58	95	56	92	52	89	51	87	34	79	29	67	23	77
95	65	93	64	89	58	85	52	82	38	75	33	59	27	71
[o]98	[o]60	96	55	92	52	91	53	87	35	78	23	65	20	---
---	58	---	58	---	52	---	50	---	32	---	22	---	18	---
92	65	90	58	88	58	86	58	82	37	73	33	67	26	71
[f]96	[f]60	94	56	90	50	88	48	82	35	75	25	---	---	---
99	56	95	55	92	47	92	56	89	32	83	26	73	20	81
99	52	97	51	93	49	92	51	84	33	79	24	63	21	79
95	55	95	55	92	49	89	54	84	32	79	22	63	19	78
100	63	92	58	89	60	89	58	86	38	80	32	74	26	78
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
91	46	98	44	103	40	88	26	84	22	70	8	64	—7	138
90	43	100	42	94	35	90	30	79	20	---	---	---	---	---
93	45	102	48	105	37	89	27	80	21	69	8	62	—8	139
91	41	100	45	99	36	90	30	82	24	65	9	56	—1	143
88	42	100	44	98	36	91	29	80	25	65	9	56	—2	143
97	36	96	38	94	30	84	26	82	23	64	—2	48	—29	143
93	42	98	46	95	39	87	30	78	25	76	5	---	---	---
97	47	102	50	102	40	97	27	80	21	72	5	62	—10	132
97	46	100	50	101	40	92	27	81	23	71	8	53	—9	129
96	48	102	50	100	36	90	28	84	26	62	0	50	—22	144
99	41	104	47	---	---	---	---	76	28	63	0	48	—25	---
---	---	94	41	95	32	85	27	77	22	60	—1	52	—18	---
95	39	99	38	101	32	87	22	78	17	67	2	57	—7	---
88	34	102	38	99	33	87	20	80	20	66	5	58	—6	145
92	40	108	41	104	33	97	18	86	11	72	—2	61	—10	149
93	42	99	44	99	32	89	26	80	25	60	2	54	—12	130
89	51	97	57	85	50	---	32	62	30	60	2	54	—16	---
89	46	93	45	95	43	86	38	78	32	65	25	47	13	91
89	56	93	56	92	50	88	40	77	33	66	26	49	9	89
91	48	[g]92	[h]46	95	43	88	41	81	30	75	20	54	8	96
92	46	94	48	93	44	86	35	78	29	65	20	44	10	92
90	52	94	56	96	50	---	---	78	30	64	18	48	6	---
92	44	96	40	96	43	86	35	80	28	66	25	46	9	93
92	46	---	---	---	---	---	---	---	---	---	---	---	---	---
91	46	96	46	95	42	86	36	76	31	67	24	47	6	96
---	54	---	55	---	48	---	---	---	---	---	---	---	---	---
92	46	94	50	96	46	84	38	80	30	68	24	59	18	91
96	54	95	58	94	51	89	41	84	34	72	27	56	16	89
93	51	94	53	98	45	87	39	83	31	69	21	54	6	95
89	49	97	50	96	46	89	42	81	33	68	28	50	14	91
89	49	95	48	92	45	87	41	81	33	68	28	50	14	89
96	61	98	57	---	---	---	---	---	---	---	---	---	---	---
93	53	96	50	94	48	87	38	82	33	70	24	53	14	89
96	47	97	43	95	44	88	34	83	32	70	20	54	11	93
97	50	99	50	98	46	88	39	82	30	69	22	53	12	96
88	54	89	48	92	45	86	38	76	32	69	21	48	10	92
96	47	98	46	97	43	90	39	82	31	68	28	50	14	95
94	45	[e]96	[e]45	97	41	88	33	82	30	67	19	50	11	95

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°
Ohio—Continued.										
Fostoria	68	5	66	12	62	4	78	24	85	30
Garrettsville	66	2	64	10	60	—11	76	17	81	24
Georgetown	67	11	68	17	66	2	81	28	90	35
Granville	66	6	65	15	----	----	----	----	86	32
Gratiot	66	7	68	14	62	5	76	25	84	31
Greenville	62	5	65	14	58	4	74	26	82	34
Hanging Rock	75	15	73	19	69	3	81	27	89	35
Hassan	64	2	80	10	72	2	----	26	84	33
Hiram	65	4	62	14	58	0	75	22	81	31
Jacksonboro	64	4	66	16	68	2	78	28	88	36
Jefferson	65	7	63	14	59	— 4	76	22	78	31
Kent	66	6	68	10	60	— 1	71	30	80	32
Kenton	70	7	68	16	63	6	77	24	87	30
Leipsic	----	----	72	14	66	3	78	26	92	34
Logan	69	9	70	15	67	3	80	24	91	31
Lordstown	66	7	65	12	63	—12	77	18	82	25
McConnelsville	70	9	69	14	65	— 1	80	24	----	----
Marietta	69	11	68	17	67	— 2	81	27	86	35
Napoleon	66	6	65	16	60	9	78	24	90	31
New Alexandria	64	6	63	13	62	— 1	75	22	84	32
New Comerstown	66	7	64	14	62	— 2	77	23	86	28
North Lewisburg	66	5	67	12	66	2	78	25	92	32
Oberlin	66	6	64	14	59	0	74	23	82	33
Ohio State Univ'y	68	8	66	16	63	4	75	27	86	32
Orangeville	62	12	----	12	61	—14	75	18	82	25
Pomeroy	69	12	69	17	69	8	81	29	92	33
Portsmouth	72	17	72	22	68	10	86	32	90	37
Salineville	56	17	63	13	62	11	79	25	----	----
Sandusky	69	7	68	12	60	8	84	26	84	34
Shiloh	65	6	66	18	60	5	74	30	86	28
Tiffin	66	8	66	15	61	5	79	23	87	31
Toledo	71	5	67	13	60	6	75	26	86	35
Upper Sandusky	66	7	65	13	59	4	76	25	85	33
Vienna	62	5	62	10	57	—10	74	19	83	30
Wapakoneta	66	3	65	13	58	4	76	26	90	34
Wauseon	66	1	64	5	61	0	78	21	88	28
Waverly	70	16	71	21	66	10	82	32	90	38
Waynesville	----	----	----	----	62	3	72	29	84	36
Westerville	65	8	65	16	62	5	75	26	85	33
West Milton	65	6	67	15	67	4	78	28	94	37
Weymouth	----	----	62	12	60	— 4	78	20	84	26
Wooster	66	4	64	14	60	1	74	23	83	30
Yellow Springs	66	3	66	13	61	2	73	20	84	32
Youngstown	65	9	65	13	60	— 2	76	20	84	29
Oregon:										
Albany	50	10	54	11	60	29	82	32	92	38
Ashland[1]	47	10	52	14	63	28	76	32	84	38
Ashland[2]	48	5	53	14	62	21	----	22	88	36
Astoria	50	21	53	16	59	32	68	32	76	40
Baker City	45	—14	51	—11	59	10	81	18	85	27
Bandon	54	22	59	23	62	32	68	36	72	44
Beulah	42	—19	47	—10	60	11	82	16	87	26
Burns	----	----	----	----	68	0	m80	m18	83	24
Corvallis	51	7	53	15	63	27	83	28	84	34

[1] Pacific Railway System. [2] F. L. Carter.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
97	48	98	46	98	44	...	...	82	30	...	...	...	...	...
89	38	92	38	93	36	87	33	75	28	65	15	46	—4	104
96	53	98	54	97	49	88	42	85	30	72	23	56	9	96
...	...	93	48	94	44	86	37	...	...	...	...	...	...	...
90	50	94	50	92	44	85	40	80	32	68	11	51	6	89
90	46	91	49	92	45	84	38	79	29	63	22	49	11	88
95	52	96	50	95	45	90	40	85	29	75	22	57	12	93
92	56	93	45	92	37	...	...	80	31	68	20	57	16	...
88	44	91	47	92	44	86	37	76	30	64	19	45	13	92
95	50	96	53	99	47	91	40	86	31	71	25	55	11	97
90	42	94	44	94	44	...	...	70	32	64	22	52	11	...
95	45	97	45	98	41	87	35	80	28	69	20	52	11	92
97	54	94	52	94	41	89	34	69	30	62	25	...	...	...
98	49	99	44	100	44	92	38	85	30	74	20	56	7	97
92	39	92	39	96	36	88	31	76	28	66	15	44	2	108
91	48	92	47	95	44	89	38	82	33	73	20	52	8	...
90	52	92	51	92	46	87	42	81	36	74	25	55	16	94
96	45	90	46	101	42	88	37	80	32	68	23	[h]51	[h]15	92
90	45	92	47	93	42	84	35	74	30	69	21	47	10	94
92	44	94	42	94	40	89	35	80	30	70	20	49	3	96
100	49	101	49	103	45	91	38	83	29	67	23	53	10	101
90	47	93	45	93	43	86	38	78	31	67	26	50	11	93
94	48	95	45	94	43	87	36	82	31	71	20	53	6	91
94	36	94	37	95	36	87	34	74	30	66	15	44	—2	109
99	51	...	...	99	42	88	38	83	31	73	21	55	16	...
98	54	98	53	95	48	88	46	84	34	76	24	65	16	88
93	54	98	56	96	48	92	43	84	31	70	25	53	12	90
93	51	93	50	96	46	89	36	78	32	68	21	50	8	91
100	49	100	54	96	41	86	34	80	33	67	24	50	15	95
94	46	95	50	96	45	87	38	80	31	68	25	51	13	91
93	52	96	48	96	43	84	37	79	30	67	23	47	11	92
93	43	95	42	97	41	87	37	75	31	65	16	45	9	107
101	45	98	47	100	40	88	36	76	30	...	...	...	...	...
96	39	98	42	100	41	88	34	82	29	69	17	50	6	100
95	53	96	53	95	50	92	46	85	34	75	26	56	13	86
92	53	94	56	95	52	85	46	82	32	68	25	48	12	...
92	48	95	44	...	...	84	36	80	33	68	21	52	6	...
100	50	103	54	102	47	88	40	85	35	68	25	53	12	99
92	28	97	38	98	39	96	37	84	29	70	23	57	0	...
88	46	94	45	94	40	88	38	81	30	66	24	48	15	93
94	52	...	...	...	...	85	39	...	29	69	21	...	...	...
90	48	94	43	94	40	85	34	76	32	67	21	47	9	96
95	40	94	52	102	42	91	42	73	29	73	25	56	27	92
93	43	91	54	86	50	84	46	69	32	68	24	53	21	83
99	37	98	43	95	41	94	40	76	29	74	22	58	20	94
76	45	76	50	83	50	76	42	64	38	64	35	60	34	67
92	32	101	37	93	36	89	24	70	21	65	15	52	15	115
72	48	74	62	74	47	72	44	68	32	67	32	60	28	52
92	25	98	31	93	33	90	23	71	12	68	8	51	6	117
92	30	...	...	...	...	...	...	...	...	...	...	...	[c]0	...
95	38	92	40	98	41	...	...	71	27	73	22	57	25	...

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°
Oregon—Continued.										
Creswell	50	12	57	12	70	32	88	30	----	----
East Portland	50	8	55	4	62	24	87	28	84	44
Ellensburg (Gold Beach)	----	----	54	27	61	34	63	34	83	43
Eola	61	4	57	7	62	20	79	25	84	38
Forest Grove	48	2	58	8	60	22	81	24	89	36
Gardiner	54	20	56	20	63	34	71	31	82	42
Grants Pass	51	0	60	15	71	24	87	23	98	34
Grass Valley	56	-16	50	-17	55	10	80	20	----	----
Happy Valley (Diamond)	----	----	----	----	----	----	81	17	87	29
Heppner	56	- 9	60	-17	68	9	84	25	88	32
Hood River	42	- 6	53	- 3	65	19	87	28	88	40
Hubbard	52	0	56	10	71	23	----	----	----	----
Jacksonville	48	12	53	14	64	27	80	26	88	35
Jordan Valley	42	-24	49	-24	m60	m4	82	14	85	26
Joseph	44	- 7	50	-21	52	- 3	76	16	83	28
La Grande	48	- 9	55	-19	61	24	85	19	87	32
Lakeview	----	----	----	----	----	----	----	----	----	----
Lone Rock	47	-12	54	-22	62	- 8	77	20	82	28
McMinnville	50	2	56	11	61	24	81	25	89	36
Mount Angel	54	- 1	55	8	64	30	83	28	86	36
North Powder	42	-22	52	-26	56	9	80	15	84	24
Pendleton	60	-16	64	-13	70	10	89	21	91	30
Portland	55	12	60	10	66	24	85	32	87	40
Roseburg	57	21	61	13	69	28	86	26	86	38
St. Helens	45	4	58	10	61	26	78	29	----	----
Silver Lake	40	-28	48	-30	60	9	86	10	----	----
Siskiyou	38	11	58	9	55	22	67	28	85	38
The Dalles	48	-12	55	- 2	62	16	----	----	----	----
Tillamook	54	15	54	17	58	32	----	----	----	----
Toledo	65	14	67	14	72	30	81	23	87	35
Vernonia	45	4	52	42	60	28	79	22	88	39
Weston	----	----	61	-11	66	14	85	25	88	34
Pennsylvania:										
Allegheny Arsenal	71	10	69	16	69	- 2	81	24	88	33
Altoona	69	14	66	15	68	2	77	28	80	25
Annville	64	18	75	19	77	6	82	31	85	42
Aqueduct	71	17	73	20	74	7	82	28	80	44
Bethlehem	67	17	68	17	71	2	83	26	----	----
Blooming Grove	60	10	64	6	67	2	80	25	84	40
Blue Knob	65	- 2	62	- 7	68	- 7	78	18	83	30
Cannonsburg	69	8	68	13	67	- 9	80	23	86	29
Carlisle	68	15	72	19	74	6	82	24	83	34
Catawissa	64	18	62	18	----	----	77	25	78	33
Center Valley	74	17	71	20	76	11	84	30	----	----
Chambersburg	73	11	72	15	----	----	82	24	82	30
Charlesville	73	8	67	6	74	-18	79	12	82	28
Clarion[1]	66	6	62	8	59	-10	74	18	80	29
Coatesville	77	16	73	18	76	6	81	22	84	33
Coopersburg	70	16	68	17	73	5	83	24	83	35
Corry	62	6	62	2	58	-16	76	12	81	24
Drifton	63	9	63	10	64	1	76	21	77	29
Dyberry	62	2	60	0	66	- 4	79	16	76	25

[1] Thos. Meehan,

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
90	46	94	42	84	43	83	36	69	30	71	29	56	27	90
83	41	69	47	79	50	80	39	72	41	72	38	64	35	...
92	39	89	42	95	43	87	41	74	30	73	29	53	29	91
98	39	.....	.....	.....	.....	82	41	72	28	74	26	57	28	...
75	42	76	48	72	49	81	43	73	37	64	36	61	34	56
103	36	.....	.....	100	38	98	34	79	20	75	12	67	24	...
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	...
91	27	98	31	91	34	89	27	76	12	.....	.....	.....	.....	...
99	36	101	42	95	45	90	28	77	26	71	21	66	24	118
97	44	95	49	98	51	90	38	68	33	63	27	60	27	104
[c]91	[c]56	90	42	96	41	84	34	69	28	72	24	58	24	...
96	36	94	43	92	47	90	41	69	30	68	27	53	21	84
91	26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	...
86	32	95	34	.....	.....	85	26	68	20	66	18	52	16	...
92	40	99	42	93	43	90	28	70	31	68	20	55	18	118
[l]96	[l]29	98	40	99	40	92	[h]39	81	23	75	20	57	16	...
90	28	92	36	.....	.....	86	28	72	13	68	22	56	22	...
94	35	95	38	100	[l]38	[d]93	[d]36	74	28	74	24	56	26	98
92	42	92	45	97	42	86	40	67	31	73	26	57	27	98
89	31	99	33	90	33	.....	.....	75	11	63	7	.....	.....	...
100	36	105	40	99	44	90	26	78	23	68	14	63	21	121
92	45	95	48	96	48	84	40	72	35	73	30	57	28	86
96	45	93	45	95	48	89	41	77	32	72	25	62	24	83
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	...
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	65	6	...
90	40	90	50	90	45	80	45	73	30	60	37	55	30	81
98	43	98	46	94	47	87	36	66	31	64	22	61	25	...
.....	.....	72	47	70	49	75	40	69	36	.....	.....	.....	.....	...
89	37	.....	.....	.....	.....	80	33	.....	.....	.....	.....	64	32	...
92	38	94	41	97	43	85	35	71	29	.....	.....	54	32	...
.....	.....	.....	.....	97	44	.....	.....	.....	.....	.....	.....	.....	.....	...
94	46	97	49	98	43	91	36	77	33	.....	20	.....	10	100
93	47	97	48	94	51	87	35	74	38	69	22	56	14	92
94	56	102	62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	...
96	59	99	56	92	51	93	40	78	27	63	18	55	10	92
94	50	.....	.....	89	49	86	34	75	27	68	21	.....	.....	...
94	54	98	46	90	43	88	36	78	26	69	16	45	0	98
90	44	93	47	94	44	87	31	71	26	68	10	44	6	101
92	42	93	40	.....	39	.....	.....	.....	.....	.....	15	.....	.....	...
97	44	101	43	92	44	91	32	79	31	66	19	56	8	95
90	50	96	48	90	43	85	36	72	29	64	22	45	10	...
.....	.....	.....	.....	.....	.....	.....	.....	78	28	69	17	58	5	...
91	33	97	40	89	37	84	29	65	28	73	15	59	—5	115
.....	.....	.....	.....	.....	.....	.....	.....	73	29	[c]63	[c]17	.....	.....	...
94	48	99	45	95	42	91	35	77	25	73	17	53	—7	93
90	50	96	48	91	50	87	38	74	30	69	21	53	11	91
90	34	92	36	93	40	90	30	76	28	68	16	44	—4	111
88	45	90	65	88	42	81	35	69	28	.....	.....	.....	.....	...
86	38	90	35	86	40	82	25	74	21	65	11	43	—11	101

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Pennsylvania—Cont'd.	°	°	°	°	°	°	°	°	°	°
Eagles Mere	57	5	55	8	54	—3	74	20	67	26
Easton		17						31		
Edinboro	59	8	58	10	58	—6	68	16	77	29
Emporium	62	9	65	7	57	—13	81	18	81	28
Erie	68	13	67	14	62	2	76	22	79	34
Frankford Arsenal	64	18	71	18	74	7	81	25	85	38
Franklin	58	8	60	8	58	—8	74	20	80	30
Germantown[1]	70	20	65	20					78	42
Gettysburg	75	10	72	19			83	21	83	32
Girardville	64	14	64	15	67	5	77	22	76	31
Grampian Hills	60	6	60	12	62	—14	76	14	80	28
Greenville	66	6	64	12	61	—8	76	20		
Harrisburg	67	15	74	18	72	8	81	28	79	38
Hollidaysburg	71	8	68	4	63	—16	80	20	84	29
Honesdale	62	9	59	3	64	—1	77	19	76	29
Huntingdon	72	12	68	8	62	—5	81	20	88	31
Indiana			64	11	66	—8	75	18		
Johnstown	72	10	67	12	68	—4	75	23	82	33
Kennett Square	59	17	59	18	64	7	74	30	74	42
Lancaster	58	15	70	15	76	—4	79	19	80	34
Le Roy	59	7	57	6	61	0	78	20	77	30
Lewisburg	65	15	66	16	61	2	84	22	83	30
Lewistown	66	13	72	16			85	23	83	31
Ligonier							87	19	86	28
Lock Haven	66	12	68	12	51	—12	84	20	80	29
Lynnport	66	13	68	12	71	4	85	20	85	29
McConnellsburg	74	13	71	16	71	—3	82	22	80	34
Mauch Chunk	64	12	67	14	72	6	82	20	79	30
Meadville					58	—3	73	17	79	30
Meshoppen		12		8		—3		24		
Myerstown	66	20	70	15	73	2	82	22	82	32
New Bloomfield	67	10	79	16	68	—1	82	20		
New Castle	68	8	65	12	65	3	78	21	85	26
Nisbet		16		15		—2		30		23
Petersburg	70	8	69	9	61	—6	81	20	88	30
Philadelphia	72	19	69	21	73	9	81	30	84	39
Philipsburg	65	5	63	4	66	—21	78	18	83	25
Phœnixville										
Pittsburg	71	11	68	16	68	5	78	28	86	37
Pleasant Mount		7		8		0		20		33
Pottstown	67	19	71	19	76	5	83	28	84	27
Quakertown	70	14	69	15	73	4	82	22	81	31
Reading	66	15	70	17	75	9	83	19		
Rimersburgh	61	6	63	5	59	—8	76	18	88	36
Salem Corners	58	8	59	6	62	0	73	22	98	31
Selins Grove	66	14					82	25	81	34
Somerset	65	3	65	10	65	—17	76	21	82	26
South Eaton	64	11	63	9	65	5	80	19	78	30
State College	65	7	69	10	64	—6	76	23	76	27
Swarthmore	67	18	68	21	72	8	80	24	82	38
Tipton	71	8			68	—14	78	26	95	33
Troy	64	12	61	10	64	—5	82	22	77	31
Tuscarora (Kilmer)	70	18	72	21	70	2	82	28	82	47
Uniontown	72	10	66	19	74	—10	79	28	86	34

[1] Thos. Meehan.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
80	42	88	45	82	41	79	34	64	29	54	12	38	−4	92
----	62	----	----	----	54	----	----	----	----	----	----	----	10	----
90	44	89	42	90	34	83	34	69	30	61	20	37	9	96
91	39	94	38	92	35	84	32	75	29	67	18	48	7	107
85	46	94	50	89	47	87	39	73	32	66	26	51	9	92
94	50	99	48	95	46	89	40	80	26	71	20	52	11	92
88	44	92	46	92	40	84	32	----	----	----	----	----	----	----
89	60	95	55	90	59	86	44	70	34	69	22	46	18	----
94	42	100	41	98	45	----	----	----	----	----	----	----	----	----
89	47	92	44	85	40	84	36	70	31	62	19	46	10	87
90	40	96	42	94	46	84	34	74	30	68	16	44	0	110
89	43	95	38	96	37	87	35	73	32	66	14	50	1	----
92	51	96	50	88	50	86	42	76	34	64	22	55	14	88
95	40	98	40	96	43	89	29	77	27	71	20	57	−2	112
87	44	89	40	87	41	82	32	69	25	59	15	45	−9	98
93	39	98	33	93	40	88	31	78	24	d73	d20	52	5	103
----	----	94	41	----	----	84	32	76	28	70	15	47	7	----
88	41	93	45	94	44	84	36	76	34	----	----	51	7	----
84	57	----	----	----	----	----	----	----	----	----	----	----	----	----
92	46	----	----	----	----	79	30	76	27	68	38	m56	m9	----
90	42	93	46	88	45	84	32	70	29	65	16	40	0	93
94	45	100	44	93	42	88	34	75	26	64	19	48	6	98
95	45	100	46	93	43	----	----	----	----	----	----	----	----	----
91	39	94	40	96	38	87	30	76	28	----	15	52	4	----
92	42	97	42	94	41	90	33	75	26	----	----	50	0	----
97	45	96	43	92	41	87	30	----	----	----	----	----	----	----
91	42	97	45	92	40	91	35	78	32	68	18	58	6	100
93	44	95	42	91	46	87	31	75	23	----	17	48	4	91
86	50	91	47	91	----	84	35	71	32	65	15	43	8	----
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
95	47	98	44	92	40	90	33	80	26	67	19	52	1	97
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
91	38	95	38	98	36	90	28	76	28	68	14	45	2	96
----	58	----	54	----	53	----	40	65	32	----	21	----	3	----
95	42	100	45	96	46	102	33	84	26	74	20	58	4	106
92	55	97	54	94	51	88	45	79	36	70	23	52	17	88
f92	f37	94	35	94	39	89	27	75	28	f70	f19	50	−8	115
----	----	----	----	----	----	88	36	74	29	73	22	54	10	----
92	47	94	53	94	45	89	40	78	35	73	23	52	16	89
----	50	----	49	----	----	----	40	----	31	----	14	----	----	----
94	51	99	51	94	50	89	39	75	28	71	21	53	12	94
90	45	96	42	90	44	87	34	76	22	71	18	52	5	92
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
----	----	94	58	93	40	82	34	74	30	62	18	46	0	----
85	46	92	50	88	54	82	47	79	34	65	18	40	12	92
92	----	99	52	94	----	87	37	81	----	60	18	47	6	----
86	45	92	40	93	34	83	32	75	28	70	32	50	1	110
87	44	92	43	88	47	82	35	75	26	61	17	47	−3	95
88	43	94	41	90	44	86	32	73	28	66	17	48	1	100
----	----	96	50	d92	d50	86	43	77	31	71	22	51	15	----
?107	?55	110	50	?107	50	90	35	79	34	76	21	----	----	----
88	48	98	48	91	47	g80	g32	71	32	61	20	50	−13	111
97	60	101	57	92	53	90	40	76	32	65	22	53	10	99
91	43	94	48	95	43	87	41	79	36	78	20	53	9	105

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Pennsylvania—Cont'd.	°	°	°	°	°	°	°	°	°	°
Waynesburg	70	9	66	----	----	----	----	----	86	----
Wellsborough	63	10	62	4	64	—9	82	20	80	26
West Chester	72	16	69	18	73	5	80	25	82	35
Westtown	n58	n18	70	19	72	8	----	----	82	36
Wilkes Barre	65	12	66	12	71	7	83	22	89	30
Wysox	64	9	63	10	64	—4	d80	d15	----	----
York	66	12	70	19	75	4	82	23	83	34
Rhode Island:										
Block Island	57	14	58	14	53	11	63	28	66	42
Bristol	58	12	59	12	56	6	62	25	78	41
Fort Adams	69	10	64	7	56	5	70	24	70	35
Kingston[1]	63	8	64	10	67	5	70	24	77	35
Kingston[2]	61	9	63	8	67	3	75	22	75	36
Narragansett Pier	63	11	65	8	59	3	71	22	78	38
Newport	58	15	62	12	62	10	67	28	----	----
Olneyville	69	12	70	10	72	5	72	26	77	39
Providence[3]	64	12	65	10	66	6	70	28	----	----
Providence[4]	63	8	64	5	67	2	70	23	80	37
South Carolina:										
Aiken	76	28	82	35	82	25	----	----	----	----
Allendale	----	----	----	----	----	----	----	----	90	46
Batesburg	----	----	----	----	----	----	----	----	94	43
Belmont	76	28	79	31	78	19	85	35	87	42
Blackville	----	----	----	----	----	----	----	----	92	46
Branchville	----	----	----	----	----	----	----	----	92	40
Brewer Mine	80	26	81	29	----	----	----	----	----	----
Charleston	78	36	79	39	82	25	88	47	86	51
Cheraw	80	24	79	30	82	21	88	36	94	42
Chester	----	----	----	----	----	----	----	----	95	36
Columbia	78	27	82	32	83	21	86	40	91	45
Conway	81	30	----	----	80	30	86	42	88	55
Evergreen	----	----	76	24	74	18	----	----	88	36
Florence	----	----	----	----	----	----	----	----	92	49
Greenville	----	----	----	----	----	----	----	----	88	38
Greenwood	74	20	80	36	78	20	----	----	90	42
Hardeeville	80	27	83	38	85	24	91	36	90	45
Jacksonboro	----	----	----	----	----	----	----	----	92	42
Kingstree	----	----	----	----	----	----	----	----	90	42
Kirkwood	----	24	----	33	----	22	----	39	----	48
Port Royal	74	36	74	39	75	27	88	48	85	54
St. Georges	----	----	----	----	----	----	----	----	88	42
St. Matthews	----	----	----	----	----	----	----	----	94	45
Simpsonville	----	----	80	20	82	18	90	33	95	42
Spartanburg[5]	79	17	78	21	76	11	88	31	92	30
Spartanburg[6]	76	26	78	30	72	20	80	42	90	40
Statesburg	78	28	80	34	82	22	86	41	86	46
Timmonsville	----	----	----	----	----	----	82	45	86	52
Trial	79	27	82	34	83	22	89	33	86	41
Walhalla	71	22	72	33	71	28	81	40	82	49
Winnsboro	76	26	76	32	79	18	90	37	91	42
Yorkville	78	24	82	27	78	16	87	33	88	40
South Dakota:										
Aberdeen	----	----	----	----	55	—20	89	10	93	15
Alexandria	45	—24	50	—25	47	—14	83	20	96	23

[1] N. Helme.
[2] C. O. Flagg.
[3] City engineer's office.
[4] D. W. Hoyt.
[5] J. F. Bayerly.
[6] Cotton belt.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
93	-----	92	54	94	40	84	31	71	27	-----	-----	-----	-----	---
90	40	94	35	88	40	88	30	75	26	65	16	45	—10	104
90	51	96	51	90	46	86	41	74	32	71	20	51	14	91
89	50	-----	-----	-----	-----	85	40	72	29	70	22	50	13	---
91	42	98	41	91	41	88	32	79	24	-----	-----	48	— 9	---
90	40	97	38	91	42	85	31	75	22	66	17	43	— 9	---
94	46	101	43	93	42	88	34	77	28	69	19	56	6	97
80	50	85	54	79	53	74	48	70	41	60	19	54	10	75
85	48	88	50	81	50	80	38	70	34	64	16	50	5	83
83	46	93	47	88	46	82	40	80	34	58	15	55	4	89
86	43	92	47	89	38	80	34	75	32	69	13	54	1	91
86	47	91	47	84	45	81	36	72	32	69	13	52	3	88
88	48	90	47	87	47	81	36	75	31	68	14	55	4	87
86	52	-----	-----	-----	-----	80	42	74	35	64	19	-----	-----	---
85	51	93	52	87	52	82	40	76	35	70	16	54	6	88
88	50	96	52	90	52	81	40	74	35	67	16	52	6	---
88	44	95	46	90	48	83	34	80	29	68	13	51	2	93
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	78	33	70	27	---
100	65	98	60	95	57	91	55	88	36	79	32	-----	-----	---
100	64	98	60	95	57	90	52	84	30	78	31	-----	-----	---
97	64	95	61	91	56	80	50	84	31	76	26	67	22	78
100	66	100	61	96	57	90	55	86	35	80	30	-----	-----	---
102	62	100	56	92	56	90	54	86	32	82	26	-----	-----	---
-----	-----	104	58	95	52	95	52	88	33	80	28	68	27	---
98	69	92	66	93	65	90	58	89	41	81	38	75	34	73
103	61	102	56	96	52	90	54	88	32	84	24	68	19	84
102	m74	94	60	95	61	93	59	89	42	83	36	-----	-----	---
99	65	95	61	93	57	91	53	87	33	81	28	68	25	78
97	66	93	58	-----	-----	-----	-----	87	46	84	28	76	24	---
97	62	94	62	91	57	87	50	85	30	76	20	68	20	---
100	62	99	57	94	58	91	54	88	44	78	28	-----	-----	---
96	60	95	63	89	55	90	50	85	30	81	20	-----	-----	---
102	60	97	60	96	55	91	51	85	32	79	30	-----	-----	---
98	64	94	60	96	60	90	52	88	40	80	36	-----	-----	---
100	60	90	57	95	54	92	57	88	34	84	32	75	23	---
100	59	99	57	94	57	98	55	89	34	82	28	-----	-----	---
-----	61	-----	62	-----	58	-----	55	-----	32	-----	23	-----	25	---
97	73	94	70	94	68	90	59	86	45	80	39	73	34	70
100	64	96	57	94	56	93	56	87	36	86	32	-----	-----	---
98	64	95	61	94	58	90	54	86	44	82	26	-----	-----	---
102	62	100	56	95	58	93	51	89	29	80	25	68	22	---
99	56	98	52	99	50	92	49	90	22	75	35	76	14	88
94	60	98	59	92	50	92	50	88	34	82	26	68	24	78
95	66	93	60	90	58	87	55	85	38	78	33	69	26	73
95	69	88	70	-----	-----	89	59	-----	-----	-----	-----	-----	-----	---
99	68	96	58	91	58	-----	-----	88	36	76	32	72	28	---
88	68	89	64	86	61	83	55	-----	-----	73	25	66	20	---
-----	-----	98	66	96	55	91	56	85	30	82	32	-----	-----	---
97	61	95	56	91	51	91	49	85	30	80	27	68	24	81
96	30	g103	g36	100	35	88	20	82	12	63	1	51	— 5	---
98	45	103	46	103	37	95	26	79	15	68	— 1	62	—14	128

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
South Dakota—Cont'd.	°	°	°	°	°	°	°	°	°	°
Brookings	43	—28	48	—35	54	—28	84	10	90	23
Canton	53	—24	58	—23	54	—12	84	15	91	23
Clark	44	—28	50	—20	59	—16	85	14	93	24
Cross (Etta Mine)	----	----	----	----	----	— 4	69	14	----	32
De Smet	34	—25	----	—17	38	—11	63	27	71	33
Flandreau	----	—24	----	—26	----	—15	----	10	93	20
Fort Bennett	46	—25	55	—28	68	—13	89	12	91	24
Fort Meade	54	—26	63	—29	64	— 1	81	6	91	27
Fort Randall	58	—24	59	—23	65	— 3	84	20	92	27
Fort Sully[1]	48	—24	56	—31	68	—11	90	19	93	30
Fort Sully[2]	46	—25	56	—30	69	—12	86	18	90	29
Highmore	----	----	----	----	62	—17	87	13	93	27
Howard	----	----	----	----	----	----	----	----	----	----
Huron	43	—28	45	—24	50	—15	84	17	92	23
Kimball	45	—24	56	—27	60	—10	82	18	91	25
Milbank	----	—31	----	----	----	----	60	22	87	30
Oelrichs	----	----	----	----	69	—12	k78	k11	91	24
Onida	40	—20	46	—28	56	2	84	19	90	22
Parkston	52	—26	58	—29	56	—12	82	18	88	28
Rapid City	56	—24	66	—27	68	— 3	82	8	90	25
St. Lawrence	----	----	----	----	----	----	----	----	----	----
Scranton	40	—23	44	—33	60	—12	87	30	94	33
Sioux Falls	----	----	----	----	----	----	----	----	----	----
Spearfish	55	—20	62	—23	66	3	76	20	83	28
Vermillion	55	—24	58	—25	57	—10	80	13	88	28
Webster	50	—30	50	—28	51	—23	80	11	90	20
Wolsey	44	—29	48	—28	52	—16	82	13	96	19
Woonsocket	44	—28	48	—29	54	—16	84	16	96	23
Yankton	56	—22	60	—17	56	— 7	86	15	88	32
Tennessee:										
Andersonville	76	21	71	26	74	16	78	31	85	36
Arlington	----	----	----	----	----	----	----	----	92	40
Ashwood	71	24	75	24	70	16	80	39	88	42
Austin	76	21	75	24	73	16	82	34	88	38
Bolivar[3]	75	25	----	----	----	----	----	----	----	----
Bolivar[4]	----	----	----	----	----	----	----	----	86	40
Brownsville	----	----	----	----	----	----	----	----	92	46
Chattanooga	75	25	78	27	76	15	86	38	89	40
Clarksville	73	19	74	22	75	13	82	35	87	39
Cog Hill	75	27	78	30	80	21	83	42	92	50
Covington[5]	75	24	73	26	77	18	79	40	86	49
Covington	----	----	----	----	----	----	----	----	90	42
Cumberland Gap	69	22	74	28	67	16	76	32	80	36
Dare	----	----	----	----	----	----	----	----	----	----
Dyersburg[6]	----	----	----	----	79	14	83	41	92	46
Dyersburg	74	22	73	23	77	13	81	37	96	40
Fayetteville	73	26	78	28	75	18	84	42	92	40
Florence Station	74	22	75	26	69	18	76	40	86	45
Franklin	----	----	----	----	----	----	----	----	----	----
Grand Junction	----	----	----	----	----	----	----	----	88	41
Greeneville	72	22	78	26	72	18	78	31	81	38
Grief	73	23	74	28	72	16	82	38	88	38
Hohenwald	76	20	78	18	75	16	85	36	88	34

[1] U. S. post surgeon.
[2] Signal Service.
[3] H. C. Calahan.
[4] F. S. Luther (Hospital for Insane).
[5] J. I. Hall.
[6] J. F. Pickett.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
90	39	94	41	99	35	91	25	74	28	68	0	56	—20	134
98	47	101	49	95	39	87	30	76	25	65	7	58	—12	125
95	43	105	41	·99	35	91	27	79	19	64	4	54	—20	133
97	40	-----	-----	[f]96	[e]38	[h]86	·[f]22	-----	-----	[n]74	[m]16	-----	-----	---
82	52	85	58	82	53	77	40	62	27	53	11	-----	—13	110
94	43	95	43	98	37	91	26	75	12	75	4	53	19	124
102	42	107	45	106	41	91	30	86	16	75	0	61	— 9	135
96	43	101	51	101	48	87	28	74	27	70	10	73	— 5	130
96	49	104	50	103	42	98	30	80	18	75	10	70	— 6	128
99	50	106	56	105	43	93	32	86	20	77	3	64	— 2	137
99	49	103	55	102	43	93	33	85	21	77	8	62	— 2	133
96	36	105	43	105	34	96	28	81	19	69	0	57	— 9	---
-----	-----	-----	-----	100	35	94	23	76	10	65	9	54	—20	---
94	45	103	47	102	35	94	25	79	14	70	0	54	—16	131
97	44	105	51	102	39	95	[d]28	74	19	62	2	60	— 3	132
98	54	98	50	106	48	97	35	85	29	78	6	60	7	---
-----	-----	104	39	104	39	93	25	81	16	70	10	60	0	---
-----	-----	104	53	[d]104	[d]40	88	24	84	19	69	4	-----	-----	---
92	46	95	45	-----	-----	-----	-----	-----	-----	-----	-----	70	— 4	---
99	45	99	55	101	46	92	32	79	25	75	13	75	3	128
-----	-----	-----	-----	101	[g]52	92	32	[d]80	[j]28	-----	-----	58	— 9	---
97	54	100	59	102	51	89	32	75	28	66	6	55	— 7	135
92	52	96	54	98	36	87	34	74	22	60	0	52	—17	---
96	44	105	61	96	47	88	33	78	29	69	18	71	4	128
97	48	101	45	96	39	-----	32	-----	21	-----	10	53	— 8	126
88	44	98	43	98	31	85	24	77	26	70	7	56	—19	128
95	50	104	59	103	34	96	26	75	15	68	—2	55	—11	133
99	42	105	46	104	32	95	24	80	12	69	—6	57	—21	134
93	50	98	51	99	41	93	33	75	22	74	9	67	— 7	121
93	58	95	57	92	48	89	52	79	30	76	23	56	18	79
98	56	98	54	93	50	90	46	86	34	76	32	-----	-----	---
96	65	97	63	92	53	86	50	83	33	76	28	65	23	81
96	64	98	56	96	55	88	50	84	33	76	24	62	20	82
[m]92	[m]74	[m]94	[m]70	85	69	-----	-----	86	35	78	30	-----	-----	---
94	60	96	58	92	54	88,	47	86	30	78	26	-----	-----	---
100	62	100	60	96	55	90	48	86	30	78	30	-----	-----	---
95	62	95	64	93	56	90	55	84	33	79	28	65	26	80
98	60	98	61	95	54	89	44	84	33	80	26	62	20	85
100	65	100	70	-----	-----	91	60	-----	-----	-----	-----	-----	-----	---
91	66	94	64	90	61	87	49	84	30	75	30	68	21	76
98	60	100	55	97	53	89	48	84	30	75	32	-----	-----	---
86	56	86	57	82	50	82	52	72	31	74	26	55	21	70
-----	-----	95	61	93	54	-----	-----	83	30	77	22	-----	-----	---
98	63	96	64	96	58	90	49	-----	-----	-----	-----	-----	-----	---
104	57	104	55	99	52	97	45	86	27	76	27	-----	-----	---
98	62	98	64	93	57	90	55	82	30	76	28	66	24	80
94	68	94	68	91	58	88	52	85	31	75	30	65	23	76
-----	-----	-----	-----	-----	-----	91	50	88	30	78	28	66	20	---
94	60	100	58	93	56	89	47	86	28	77	30	-----	-----	---
89	61	90	61	85	52	84	52	76	30	75	25	59	21	72
98	58	-----	-----	93	54	-----	-----	-----	-----	-----	-----	-----	-----	---
102	58	101	55	97	48	92	46	84	26	80	23	70	16	86

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Tennessee—Continued.	°	°	°	°	°	°	°	°	°	°
Jacksboro	72	20	73	24	70	15	79	31	84	37
Kingston Springs	72	21	74	21	71	17	82	35	86	33
Knoxville	73	24	76	26	76	15	80	35	88	37
Lawrenceburg	64	21	74	22	73	16	78	37	88	32
Lewisburg	73	23	74	23	72	19	79	39	90	42
Lookout Mountain										
Lynnville	72	20	76	20	70	10	80	32	86	34
McKenzie	70	25	74	26	78	18	83	40	90	37
Memphis	79	23	79	26	81	17	83	39	89	48
Milan[1]	74	21	74	24	77	15	83	37	88	39
Milan									94	37
Missionary Ridge										
Nashville	75	20	77	23	79	16	82	37	89	37
Nunnelly	76	20	75	22	72	15	81	34	86	33
Parksville	72	24	74	27	74	18	80	34	87	39
Riddleton	76	20	75	23	75	16	80	34	90	38
Rogersville	70	20	70	28	72	19	79	36	85	41
Rugby	66	16	72	20	69	13	79	36	84	38
Savannah	75	24			74	22	80	38	88	42
Sharps			76	28	72	18	82	42	90	40
Springdale	78	20	72	26	70	18	82	32	89	42
Trenton	72	22	74	23	65	10	78	31	85	39
Union City										
Watkins	77	18	78	25	75	16	85	37	91	40
Waynesboro	73	24	74	24	72	20	86	38	92	32
Woodstock	79	24	77	27	72	16	83	41	91	54
Texas:										
Abilene	83	17	85	12	92	20	90	34	95	47
Austin[2]	80	26	80	22	89	22	89	41	91	51
Austin[3]	80	28	81	22	91	25	87	45	95	56
Belton									94	46
Berlin										
Brady	[j]82	[j]11	[j]85	[j]15	93	14	91	34	91	46
Brazoria	79	31	83	30	84	24	85	41	89	55
Brenham			83	23	90	23	87	35	93	54
Brownsville	82	37	89	36	89	31	88	53	94	64
Brownwood	80	17	81	17	91	17	90	36	94	47
Burnet									89	60
Caddo Peak	80	18	83	14	89	20	87	38	94	50
Camp del Rio			90	18	105	10	101	19	[j]103	[j]35
Camp Eagle Pass	85	17	93	27	105	20	95	39	102	56
Camp Pena Colorado	81	11	83	16	87	17	90	24	96	41
Childress	88	20	86	5	100	10	96	37	94	47
Cold Water										
College Station	84	26	84	20	90	22	87	45	95	55
Colorado	84	15			94	15	94	32	96	48
Columbia	80	30	82	30	85	24	85	43	92	60
Corpus Christi	80	32	85	30	89	28	80	50	91	58
Corsicana[4]					88	36	85	38		55
Corsicana[5]			85	30		[k]43	85	38	94	50
Cuero									[i]96	[i]62
Dallas[6]	77	20	82	18	87	18	86	40	93	60
Dallas[7]	80	19	84	11	90	20			92	54
Decatur	83	15	84	10	90	18	83	36		

[1] Dr. M. D. L. Jordan.
[2] Oscar Samostz.
[3] Dr. Q. C. Smith.
[4] W. H. Hamilton.
[5] E. L. Gibson.
[6] C. F. Mercer.
[7] M. E. Glass.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
91	56	92	58	87	51	85	49	77	31	74	23	59	18	77
		96	59	94	54	88	46			80	28			
93	58	95	62	92	53	90	53	81	32	76	26	60	23	80
95	63													
95	66	94	63	92	57	87	48	82	29	76	26	68	20	76
						[i]82	[i]51	[i]83	[i]29	74	30	60	21	
95	61	98	64	90	54	89	49					76	24	
93	68	92	64			89	52	86	38	80	32			
96	63	98	64	94	58	90	50	86	34	77	36	73	23	81
100	59	102	54	97	51	100	43	89	26	77	26			
	71				60		55	74	37		31		26	
98	62	98	60	95	54	90	49	86	32	78	29	67	22	82
95	64	94	57	94	48	86	47	81	30	78	24	68	16	80
98	59	95	61	90	51	89	54	80	32	76	26	65	22	80
98	60	94	56	92	51	88	50	83	31	77	23	69	18	82
91	64	94	67	90	53	88	53	78	31	73	24	53	19	75
92	56	93	60	90	52	84	49	77	27	72	20	60	14	80
95	62					89	52	83	31			72	20	
98	68	98	66	92	56	90	50			76	30	68	18	
95	60	97	64	94	54	92	56	84	32	81	19	60	17	80
91	63	94	56	92	54	85	46	82	28	74	27	66	20	84
				96	61	92	48	87	35	74	32	68	22	
102	68	101	60	99	56	92	48	88	32					
97	60	93	57	90	51	94	46	80	28	76	26	65	20	77
98	69	97	66											
96	56	99	66	98	66	91	43	85	40	86	33	78	21	87
95	66	101	68	96	71	92	51	90	46	84	36	83	27	79
96	59	100	71	99	71	92	51	90	50	83	39	84	29	78
98	53	101	66	99	62	96	54	92	55	78	52			
						[f]96	[f]46	93	37	86	32	73	22	
94	54	98	64	97	67	88	40	[h]87	[h]35	[d]86	30	79	22	87
93	61	94	67	91	69	89	49	87	46	83	31	80	25	70
97	60	99	71	97	68	92	50	91	47	89	36	82	28	
97	66	94	69	94	72	93	55	92	52	88	44	88	38	66
100	55	102	65	102	67	94	41	90	36	85	30	78	22	85
90	58	92	76	92	72	87	55	84	48	77	35	74	30	
		[j]111	[j]44	103	54	99	36	95	25			90	22	
101	60	107	67	102	69	98	48	95	40	90	32	85	23	90
103	43	100	45	98	58	94	41	90	30	80	16	75	11	92
100	60	104	71	103	67	96	51	[d]94	[d]43			72	21	
				[i]102	[i]54	95	34	[g]89	[g]25	79	14	[c]69	[c]10	
97	61	99	72	97	68	98	48	90	46	89	37	89	24	79
[k]100	50	98	58	99	64	92	41	89	38	87	32	78	20	
97	63	98	69	94	70	93	50	88	48	85	33	82	29	74
94	65	92	70	90	74	90	55	90	50	81	42	80	35	66
103	54	105	49	102	[m]65									
96	56	100	54	100	66	97	44	80	42	80	32	74	22	
100	60	106	64	102	58	95	40	88	38	86	30			
101	65	102	70											
100	58	106	68	100	71	96	49	87	45	80	34			

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°
Texas—Continued.										
Duval	86	25	85	21	93	26	88	44	96	57
El Paso	77	20	82	19	87	23	88	34	99	52
Epworth	75	25	77	10	82	20	81	30	86	52
Forestburg	----	20	----	14	----	30	----	42	----	54
Fort Bliss	78	15	84	20	86	21	90	33	100	50
Fort Brown	83	35	89	35	89	29	86	40	89	55
Fort Clark	80	28	83	25	----	24	92	42	94	54
Fort Davis	79	19	80	19	85	19	87	30	94	45
Fort Elliott[1]	83	12	78	2	88	14	90	28	92	36
Fort Elliott[2]	83	12	78	2	87	14	90	28	90	36
Fort Hancock	83	8	83	7	91	10	95	27	105	38
Fort McIntosh	84	28	86	30	99	23	94	40	97	54
Fort Ringgold	97	29	99	25	105	20	101	39	103	62
Fort Worth	78	28	85	9	90	22	----	----	----	----
Fredericksburg	78	21	82	20	91	22	86	38	90	49
Gainesville	80	13	79	11	87	17	88	41	90	52
Gallinas	84	22	86	25	98	16	92	33	95	47
Galveston	74	35	75	34	76	30	81	56	85	63
Graham	84	11	85	11	93	12	94	36	93	43
Grapevine	----	----	----	----	----	----	----	----	----	----
Hartley	80	21	75	—1	82	11	85	10	----	----
Haskell	----	----	----	----	----	----	[f]95	35	95	50
Hearne	74	23	81	20	80	20	82	44	90	52
Houston	80	27	82	26	86	23	90	41	97	49
Howe	74	14	79	12	89	21	89	40	89	49
Huntsville	78	26	82	21	88	24	85	42	91	50
La Grange	----	35	----	29	----	29	----	50	----	60
Lampasas	82	20	86	17	95	19	91	37	[d]95	[d]48
Longview	80	22	82	20	88	19	87	41	96	50
Luling	----	----	----	----	----	----	86	48	94	54
Menardville	78	12	82	16	93	22	91	40	93	45
Merkel	----	19	----	15	----	20	----	35	----	54
Mesquite	79	18	81	16	91	18	86	40	94	48
Mountain Spring	----	----	----	----	----	40	----	32	80	50
New Braunfels	78	26	80	24	97	22	87	40	92	54
New Ulm	81	26	84	22	90	21	89	46	98	55
Ochiltree	----	----	60	—3	71	19	75	26	80	40
Orange	----	----	----	----	----	----	----	----	90	66
Palestine	79	22	81	19	87	20	85	46	88	50
Panhandle	78	11	77	—2	87	5	90	22	91	42
Panter	82	20	88	14	98	21	89	35	93	57
Paris	----	----	----	----	----	----	----	----	92	48
Pike	----	----	----	----	[c]87	[c]34	[h]86	[h]36	94	47
Rio Grande City	88	34	95	30	103	24	97	46	100	62
Round Rock	----	----	82	20	86	22	86	44	88	50
San Antonio[1]	81	25	82	24	93	21	92	42	93	55
San Antonio[2]	81	25	82	24	93	21	88	42	93	55
Silver Falls	83	11	84	9	93	14	89	30	95	42
Tyler	[j]76	[j]18	81	16	88	20	86	42	94	48
Venus	----	----	----	----	----	----	----	----	----	----
Waco	79	20	80	18	89	18	86	40	92	53
Weatherford	----	----	----	----	----	----	----	----	90	46
Utah:										
Alta	38	—5	44	—12	----	----	----	----	----	----
Beaver	57	—12	72	—18	69	—2	84	21	88	30

[1] United States post surgeon. [2] Signal Service.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
97	62	107	75	100	72	94	52	-----	-----	84	36	82	28	---
101	54	100	62	97	60	95	56	87	35	81	26	68	28	82
93	52	101	70	95	61	87	54	84	40	78	33	67	27	91
-----	60	-----	74	-----	70	-----	54	-----	50	-----	38	80	25	---
103	54	103	62	101	60	98	54	93	35	86	25	70	25	88
90	56	96	61	95	70	93	55	91	52	87	42	-----	35	67
98	60	100	70	99	70	97	51	89	41	84	38	78	27	76
96	48	92	55	90	60	86	43	81	34	75	22	70	24	77
98	51	101	60	100	55	[f]92	[f]41	-----	-----	-----	-----	-----	-----	---
97	50	100	59	100	55	91	35	-----	-----	-----	-----	-----	-----	---
107	45	106	54	105	56	100	42	92	24?	85	9	75	12	100
100	58	102	65	100	69	98	56	98	41	89	28	86	29	79
104	60	107	67	105	70	103	48	100	46	89	28	92	26	87
-----	-----	97	63	97	60	95	54	91	36	-----	-----	-----	-----	---
94	60	101	63	99	65	92	45	88	38	81	30	[d]84	[f]26	81
99	56	101	74	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
98	53	104	61	102	64	96	36	95	38	90	28	[f]82	[f]20	88
90	65	92	71	90	70	87	56	89	54	79	49	76	37	62
102	51	105	62	102	67	99	44	91	38	82	25	74	15	94
-----	[j]72	106	70	104	70	100	48	90	42	[e]82	[e]32	77	21	---
97	38	104	50	98	45	95	36	85	16	85	18	-----	-----	---
103	63	110	75	106	70	-----	-----	-----	-----	-----	-----	-----	-----	---
96	58	98	67	98	63	91	60	88	40	82	32	-----	-----	---
99	59	100	66	97	67	95	47	91	43	87	30	80	24	77
101	59	104	70	99	58	-----	-----	-----	-----	-----	-----	-----	-----	---
97	58	98	67	95	68	92	47	90	41	85	33	-----	-----	---
-----	64	-----	74	-----	74	-----	54	72	54	-----	43	-----	26	---
98	53	102	63	99	68	92	40	90	40	84	29	[d]82	23	85
101	59	102	66	100	61	99	47	90	38	81	33	77	25	83
98	60	101	70	102	68	95	44	93	45	86	32	-----	-----	---
95	58	96	72	95	69	89	50	84	37	84	31	78	22	84
-----	61	-----	72	-----	70	-----	-----	-----	-----	-----	26	-----	-----	---
103	55	106	62	100	66	98	45	88	39	82	32	77	20	90
-----	-----	102	62	99	64	96	48	88	40	83	34	76	21	---
-----	-----	97	68	95	68	90	50	86	46	85	36	84	24	---
98	58	101	69	100	66	94	50	96	47	88	39	86	26	79
98	50	107	70	104	56	95	33	-----	-----	-----	-----	-----	-----	---
94	60	94	68	92	62	90	44	86	44	82	30	-----	-----	---
94	56	97	66	96	66	93	47	88	42	80	37	81	23	78
96	49	99	59	98	50	[e]90	[e]49	-----	-----	[e]82	20	[j]66	12	---
107	62	110	75	[d]105	[d]72	100	55	89	44	88	33	-----	22	96
102	54	101	65	99	64	95	45	88	36	82	34	-----	-----	---
106	50	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---
102	62	104	70	102	71	100	52	98	50	91	37	87	31	80
96	62	103	74	100	72	92	54	90	42	82	30	80	24	---
95	58	99	69	96	68	92	46	92	46	85	37	86	28	78
94	58	100	69	98	70	92	46	92	46	85	37	86	28	79
97	52	101	59	99	59	92	37	90	32	86	30	76	21	92
100	58	102	65	98	64	97	45	87	40	82	34	-----	-----	---
-----	-----	-----	-----	100	65	96	41	90	34	83	27	76	18	---
99	58	103	66	100	69	95	43	90	41	88	34	82	21	85
98	48	98	66	102	58	96	42	88	40	86	26	[j]75	[j]20	---
-----	-----	-----	-----	-----	-----	-----	28	-----	[d]10	-----	14	40	0	---
88	29	97	44	92	38	90	29	85	21	85	10	-----	5	115

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°
Utah—Continued:										
Bingham										
Blue Creek	44	-6	59	2	57	12	87	34	89	49
Corinne	48	-12	54	-10	64	0	81	34	88	52
Fort Douglas	47	4	58	-6	64	0	78	29	84	40
Fort Du Chesne[1]	44	-23	48	2	64	4	70	20	87	28
Fort Du Chesne[2]	40	-22	49	2	63	8	78	21	86	30
Kelton	52	-22	56	-14	62	10	80	31	85	39
Lake Park	47	-9	54	-10	60	0	74	27	84	38
Levan		-10		-8		8		34		44
Logan										
Losee	50	12	63	-10	50	10	76	30	90	37
Moab	59	-4	62	-3	74	8	84	25	102	36
Mount Carmel		-12		-8		13		26	87	34
Mount Pleasant	33	1	39	-20	43	-4	56	19	63	27
Nephi	54	-23	55	-20	69	-10	76	11	87	28
Ogden[3]	50	-6	60	-16	62	-10	82	26	86	34
Ogden[4]	54	5	67	-11	65	0	80	34	87	49
Parowan										
Park City										
Promontory	42	-16	56	-6	62	10	76	26	76	35
Provo City										
Richfield					h72	h18	79	22	88	31
St. George	67	14	71	13	76	21	88	35	97	48
Salt Lake City	50	-2	58	-6	64	0	78	28	84	40
Snowville							78	26	83	41
Stockton										
Taylor's Ranch	45	-9	57	-9	61	-9	74	21	88	30
Terrace	45	-15	45	-12	68	2	85	40	87	48
Vermont:										
Brattleboro[5]	61	0	58	-4	56	-6	78	21	80	31
Brattleboro[6]	62	5	56	4	57	-1	78	25	78	34
Burlington	59	-12	51	-4	53	-2	76	24	79	35
Chelsea	54	-7	48	-6	48	-5	68	18	68	34
East Berkshire	58	-18	49	-18	47	-19	74	9	77	21
Hartland	63	-4	56	-7	49	-14	75	16	76	28
Jacksonville	55	-5	51	5	60	-9	77	16	78	25
Lunenburg	52	-8	48	-8	48	-12	70	20	78	32
Northfield	61	-10	56	-7	59	-13	71	17	73	24
Strafford	54	-6	46	-8	48	-6	68	14	70	28
Vernon	60	6	58	-4	50	8	74	28	78	34
Weathersfield Center	59	-3	52	-7	54	-10	71	19	72	29
Virginia:										
Bedford City	63	25	62	25	60	20	67	31	72	45
Birdsnest	76	26	74	28	82	20	83	32	88	48
Bolar	66	11	61	12	62	0	72	22	78	34
Cape Henry	77	27	80	31	80	22	86	40	88	49
Casanova										
Christiansburg	71	18	68	10	71	13	g84	g20	87	34
Dale Enterprise	75	17	75	18	75	10	83	24	89	40
Fall Creek Depot									88	48
Fort Monroe	71	24	73	29	76	22	82	38	87	47
Fort Myer	76	16	73	21	76	12	83	26	85	40
Lexington	76	16	74	20	75	14	83	24	88	32

[1] U. S. post surgeon.
[2] Signal Service.
[3] Central Pacific.
[4] W. W. Crossman.
[5] W. H. Childs.
[6] H. B. Chamberlain.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
----	----	----	----	----	----	----	[g]40	----	[g]28	----	14	----	17	---
98	49	106	72	98	61	88	50	71	23	56	27	47	17	112
91	45	102	67	98	62	87	47	69	28	59	15	51	15	114
89	38	100	55	97	50	87	39	70	28	65	24	57	20	106
93	32	100	44	99	37	89	27	69	22	66	10	48	6	123
92	33	100	46	98	43	88	30	69	22	64	12	49	8	122
95	49	106	58	96	49	87	47	72	28	57	15	52	8	128
89	39	99	50	95	48	84	36	66	27	58	19	51	19	109
----	45	----	68	----	62	----	47	----	34	----	----	----	----	---
----	----	----	----	----	----	----	48	----	[e]39	----	25	----	24	---
87	42	95	54	96	43	88	32	72	20	68	12	54	11	106
105	36	108	48	105	44	98	31	81	21	77	16	59	13	112
----	34	94	48	95	47	[g]88	33	79	27	----	15	----	17	---
73	26	81	42	----	41	72	29	55	18	49	13	42	12	---
90	30	99	40	99	36	88	25	72	20	67	7	57	7	122
86	36	94	45	86	52	82	52	70	34	58	24	50	20	110
90	44	99	68	95	62	89	44	----	[d]23	----	20	----	24	110
----	----	----	----	----	----	90	45	79	26	78	13	63	11	---
----	----	----	----	----	----	----	40	----	[d]30	----	15	----	10	---
90	46	104	58	98	48	86	50	80	19	69	18	61	13	120
----	----	----	----	----	----	----	[e]43	----	[f]30	----	20	----	20	---
89	33	97	49	93	41	[e]91	[d]33	75	23	67	11	[f]57	[g]10	---
104	54	112	50	108	52	100	42	89	22	84	14	66	17	99
89	38	98	52	100	50	87	39	70	30	64	24	57	20	106
82	34	97	55	91	----	81	41	65	40	62	37	57	29	---
----	----	----	----	----	----	----	[n]37	----	[g]26	----	11	----	10	---
93	30	[n]100	[n]48	[a]101	[a]42	87	28	70	22	64	10	50	6	110
96	47	104	55	100	55	88	50	70	25	65	20	50	10	119
90	39	96	41	90	40	81	30	76	26	61	10	44	—10	106
85	41	93	43	88	44	79	32	74	28	63	14	43	— 4	97
86	44	91	48	90	50	82	36	74	31	59	15	41	—10	103
76	44	82	51	83	45	72	30	68	27	62	10	30	—12	95
86	33	90	36	92	34	84	29	79	20	58	4	38	—34	126
88	36	92	40	88	[d]40	[c]85	[c]32	78	24	60	7	42	—18	110
88	35	92	36	88	36	80	27	80	22	62	6	40	—16	108
82	44	90	40	90	48	82	30	71	30	60	12	34	—16	106
83	36	89	38	88	36	79	27	74	21	58	9	41	—22	111
84	46	88	46	88	46	78	34	76	32	54	10	40	—14	102
86	50	98	48	88	48	78	34	74	30	64	8	40	—10	108
83	42	88	44	89	45	78	30	70	28	56	8	40	—10	99
86	65	84	61	80	61	75	53	70	38	60	34	52	23	66
89	62	97	64	91	61	90	53	78	43	78	28	63	23	77
82	43	86	50	97	40	82	40	74	28	70	17	56	5	87
96	56	99	64	94	61	91	58	84	38	76	30	62	24	77
93	52	97	54	97	50	92	46	79	32	73	25	58	14	---
92	37	95	38	90	43	88	45	79	29	75	22	57	13	85
90	45	96	47	94	35	88	28	78	25	73	22	60	2	94
98	60	95	61	90	58	89	50	81	36	74	29	60	23	---
94	59	96	64	92	56	88	59	82	37	75	30	60	26	74
91	49	99	53	96	45	91	43	75	29	73	22	58	14	87
94	46	96	44	95	39	92	42	80	30	78	19	62	8	88

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°
Virginia—Continued.										
Lynchburg	77	23	74	25	75	20	85	28	88	38
Marion	69	15	67	20	72	12	78	30	85	35
Mossingford	----	23	----	21	----	20	75	20	85	50
Norfolk	76	25	79	30	81	22	84	38	86	47
Nottaway	78	16	79	23	79	13	87	23	90	36
Petersburg	73	21	76	26	77	20	84	28	89	40
Richmond	78	18	80	23	87	16	88	28	87	40
Salem	72	25	68	28	69	21	80	35	87	41
Smithfield	76	27	80	28	82	24	87	34	85	50
Spottsville	74	22	79	28	80	20	84	26	----	----
Staunton	63	18	----	----	76	12	80	24	84	39
Summit	72	12	73	16	74	12	80	21	83	35
Wytheville	----	----	----	----	----	----	----	----	----	----
Yanceys Mills	----	----	----	----	----	----	----	----	----	----
Washington:										
Blakeley	50	10	52	12	58	30	76	25	78	37
Chehalis	----	----	----	----	----	----	----	----	----	34
Doe Bay	48	22	51	16	56	30	65	32	70	40
East Sound	----	----	----	----	----	----	----	----	----	----
Fort Canby[1]	49	22	52	17	56	30	64	35	73	40
Fort Canby[2]	50	22	55	18	60	34	70	34	72	44
Fort Simcoe	----	----	----	----	----	----	83	38	89	51
Fort Spokane	42	—22	51	—21	55	11	91	20	94	36
Fort Townsend	45	10	52	9	56	25	72	27	75	37
Fort Walla Walla	48	—13	65	—12	67	— 2	89	27	91	38
Lapush	----	----	----	----	----	----	----	----	63	38
Neah Bay	50	18	52	20	55	31	65	28	68	37
Olympia	52	7	55	12	56	31	80	28	82	34
Seattle	----	----	----	----	----	----	----	----	----	----
Spokane Falls	46	—23	52	—23	57	12	86	22	88	38
Tacoma	----	----	----	----	----	----	----	----	----	----
Tatoosh Island	48	22	50	30	52	32	64	29	66	30
Vancouver Barracks	49	3	59	6	65	23	85	30	85	30
Vashon	46	18	50	18	----	----	----	----	----	----
Walla Walla	56	—10	67	— 7	66	7	89	29	90	40
Waterville	*43	—16	48	—19	64	7	81	21	92	35
West Virginia:										
Ella	64	11	63	16	63	2	72	25	81	40
Kingwood	62	10	70	12	68	—10	80	25	85	30
Mount Alto	----	----	----	----	----	----	----	----	----	*38
Oceana	72	20	70	24	70	5	82	31	90	43
Parkersburg	70	12	70	18	69	4	81	29	87	36
Pleasant Hill	64	6	68	10	68	5	74	26	84	40
Seven Pines	56	15	66	22	60	3	78	22	85	32
Tannery	70	8	69	16	71	—14	78	20	84	34
Tyler Creek	78	19	76	23	68	6	80	32	----	----
Wisconsin:										
Beloit	----	----	----	----	----	----	----	----	----	----
Butternut	----	—28	----	— 7	----	—10	----	10	----	26
Cadiz	----	----	----	6	----	—20	----	30	----	36
Delavan	44	—11	51	— 3	46	—20	76	26	89	32
Embarrass	43	—30	45	—10	48	—35	75	14	84	28
Fond du Lac	----	----	----	----	----	----	71	24	85	24
Glasgow	----	----	----	1	----	6	----	30	----	30

[1] Signal Service. [2] United States post surgeon.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September.		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
95	52	97	54	93	47	90	47	81	34	81	26	62	19	78
90	48	94	50	87	43	88	43	78	26	[f]73	[f]28	56	16	82
....	[a]67	....	54	....	61	....	48	80	30	....	22	55	20	...
95	58	96	60	93	58	89	59	88	37	79	30	64	25	74
102	54	102	50	95	44	92	44	83	26	82	19	....	....	...
96	57	99	52	94	48	92	39	81	30	81	25	62	20	79
96	53	103	55	95	49	94	50	88	25	85	23	75	17	87
92	54	....	....	....	....	....	....	80	34	81	30	65	20	...
90	54	92	55	88	54	[k]85	[j]53	....	....	....	....	....	....	...
....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
94	49	98	47	96	45	92	39	80	28	78	19	62	8	...
91	45	94	46	92	42	87	37	74	22	72	18	63	8	86
88	52	88	52	85	46	82	47	78	30	70	26	54	18	...
....	....	....	[n]48	94	40	92	38	81	25	[n]76	18	61	12	...
86	42	86	44	84	45	76	40	63	34	58	34	58	30	76
94	37	96	40	95	40	90	37	72	29	64	30	54	29	...
72	42	75	47	76	47	76	45	64	39	58	36	58	32	60
[l]76	[l]46	[l]79	[l]47	78	46	74	42	64	38	56	36	58	32	...
70	48	65	51	85	50	72	46	69	44	72	39	56	38	68
75	30	69	50	89	50	76	44	68	40	73	36	58	36	71
97	51	101	58	97	58	91	57	71	40	65	32	56	30	...
96	37	105	41	99	44	92	28	64	24	62	18	52	20	127
78	38	81	45	84	47	76	40	64	35	59	31	56	30	75
98	42	106	41	100	52	89	30	71	32	69	22	66	24	119
67	43	68	45	62	43	69	28	58	26	58	17	52	14	...
71	39	74	45	72	46	73	39	60	33	57	31	56	32	56
88	37	89	42	90	46	80	36	66	30	61	31	54	32	83
....	....	....	....	86	50	78	44	64	36	60	34	55	32	...
93	41	102	45	93	48	87	33	65	29	60	23	54	25	125
....	....	....	....	....	....	82	42	68	33	57	34	59	33	...
64	34	70	36	....	....	64	40	[c]59	33	59	38	54	37	...
95	34	97	36	99	39	90	25	75	31	79	28	58	30	96
....	....	92	46	90	49	85	50	68	37	63	36	....	....	...
101	46	106	48	100	49	90	36	77	34	66	25	65	25	116
98	34	101	35	96	41	87	25	76	16	63	5	57	20	120
86	55	88	54	88	48	82	39	70	34	66	23	48	14	86
95	50	95	50	92	50	88	40	....	....	68	12	50	10	...
....	48	....	41	....	48	....	44	....	28	....	16	....	10	...
93	58	93	59	91	52	88	52	82	30	....	....	....	....	...
93	51	94	52	93	45	86	42	82	34	76	22	54	15	90
88	38	90	46	90	42	84	36	68	31	70	12	52	14	85
86	48	....	....	....	....	....	....	....	....	....	....	....	....	...
90	46	93	50	94	48	82	39	75	34	75	14	52	12	108
98	63	98	48	96	38	88	40	74	31	69	28	39	15	...
96	31	97	48	96	43	88	33	74	26	56	20	52	−2	...
....	40	....	50	....	44	....	30	....	24	....	18	38	−6	...
....	52	....	56	....	42	78	38	....	30	....	26	40	−4	...
....	....	....	....	....	....	....	....	....	....	....	....	....	....	...
92	50	94	50	86	50	85	33	75	24	56	15	48	−8	129
96	43	92	48	97	36	86	25	72	22	55	17	46	−5	...
....	....	....	[b]57	....	[l]50	....	35	....	33	....	17	....	[j]7	...

TABLE OF MAXIMUM AND MINIMUM TEMPERATURES AND

Stations.	January.		February.		March.		April.		May.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Wisconsin—Continued.	°	°	°	°	°	°	°	°	°	°
Grantsburg	47	—21	48	—15	49	—23	75	6	83	24
Green Bay	43	—22	44	— 4	44	—23	73	20	81	28
Greenwood	43	—35	48	—18	60	—30	78	21	84	24
Hayward	43	—26	55	—14	46	—23	-----	-----	-----	-----
Honey Creek	54	— 6	56	— 4	54	—20	59	35	92	30
Horicon	-----	—16	-----	-----	-----	—23	-----	4	-----	32
Ithaca	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
La Crosse	48	—23	53	— 5	50	—18	81	21	83	29
Lincoln	-----	—12	-----	0	-----	— 3	-----	—24	-----	31
Madison	47	—14	55	— 4	49	—12	72	25	84	33
Manitowoc	46	—19	53	— 9	47	—13	76	19	78	24
Milwaukee	47	—10	59	— 2	50	— 7	72	27	84	32
Neillsville	44	—36	48	—18	48	—34	80	8	92	22
Oshkosh	48	—21	46	— 6	48	—16	[j]74	22	[m]83	29
Plover	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Potosi	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Summit Lake	54	—32	56	—12	60	—20	76	4	92	28
Waucousta	-----	—20	-----	— 8	-----	—21	-----	17	-----	22
Wauzeka	-----	—29	-----	-----	-----	—28	-----	30	-----	32
Weston	-----	-----	-----	-----	-----	-----	-----	23	-----	30
Wyoming:										
Camp Pilot Butte	42	—28	54	—15	59	—12	75	15	80	29
Camp Sheridan	35	—19	40	—30	-----	— 5	77	5	77	26
Carbon	43	— 4	49	—16	54	4	74	18	78	36
Cheyenne	59	— 2	61	—20	62	2	72	13	80	28
Fort Bridger	42	—30	48	—22	57	—12	75	12	76	30
Fort D. A. Russell[1]	49	—12	55	—31	67	—15	80	8	92	5
Fort Fetterman	-----	-----	-----	-----	-----	-----	-----	-----	92	29
Fort McKinney	51	—22	64	—22	63	— 1	76	10	86	28
Fort McKinney	57	—23	66	—22	68	6	80	13	86	27
Fort Washakie[1]	45	—25	60	—24	62	— 5	74	6	82	8
Fort Washakie[2]	43	—22	60	—24	60	— 4	72	6	80	28
Lander	42	—26	58	—25	60	— 1	73	18	-----	-----
Laramie	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Lusk	56	—16	61	—26	62	8	73	15	83	28
Owen	-----	-----	-----	-----	-----	-----	-----	-----	[1]74	[1]28
Saratoga	45	—27	52	—23	53	— 7	69	20	80	34
Wheatland	28	—12	58	-----	47	-----	-----	-----	69	-----

[1] U. S. post surgeon. [2] Signal Service.

ANNUAL RANGE OF TEMPERATURE FOR 1890, ETC.—Continued.

June.		July.		August.		September		October.		November.		December.		
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Range.
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
103	45	95	40	84	38	81	28	70	21	60	14	-----	-----	125
94	47	92	48	91	41	86	32	71	26	56	20	47	2	117
98	42	95	39	89	30	84	25	75	20	54	12	50	—15	133
						83	23	78	16	70	7	(?)68	—16	---
99	50	96	52	99	40	86	30	72	26	56	22	50	0	119
-----	-----	-----	-----	°82	°41	85	31	72	23	-----	20	-----	3	---
95	50	97	52	96	43	88	31	74	23	60	17	52	2	120
-----	50	-----	54	-----	53	-----	42	-----	32	-----	28	-----	14	---
93	50	91	54	93	46	83	36	69	25	53	23	46	5	107
94	40	92	41	90	40	81	30	70	25	58	19	49	— 2	113
95	48	94	52	96	48	88	38	71	28	57	25	51	7	106
102	40	100	42	94	34	88	23	74	19	56	9	47	—10	138
95	52	92	50	94	44	85	34	71	26	57	21	58	3	116
-----	-----	-----	-----	94	36	86	28	74	20	58	13	45	0	---
94	57	96	54	98	50	89	36	°76	°45	-----	-----	-----	-----	---
102	46	101	50	90	40	-----	-----	-----	-----	-----	-----	-----	-----	---
-----	40	-----	44	-----	34	-----	24	-----	22	-----	-----	-----	-----	---
-----	-----	90	63	-----	54	-----	40	-----	34	-----	28	-----	10	---
-----	53	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	°2	---
°85	28	94	41	92	32	83	23	72	13	66	—11	52	—13	122
87	29	91	39	88	36	79	20	-----	16	-----	2	47	2	121
90	30	92	48	89	39	84	28	69	22	66	11	°61	13	112
85	26	92	37	89	34	80	21	-----	-----	-----	-----	-----	-----	---
100	25	100	42	104	31	98	21	81	14	70	2	70	3	135
104	32	108	40	105	29	104	29	85	18	70	5	59	3	---
87	39	97	52	92	44	83	23	70	27	70	10	70	9	119
86	30	97	51	92	44	84	22	71	28	69	7	68	5	120
85	32	95	39	93	39	84	23	72	15	70	9	57	2	120
84	31	93	37	91	39	83	24	71	17	69	9	57	3	117
-----	-----	-----	-----	-----	-----	76	28	67	21	60	0	53	0	---
°96	°33	97	45	94	40	87	26	72	17	65	8	60	10	123
88	52	92	44	92	35	86	28	-----	-----	-----	-----	-----	-----	---
88	37	99	54	90	47	-----	-----	69	23	60	0	47	—14	---
84	33	84	50	-----	-----	-----	-----	-----	-----	-----	-----	36	0	---

APPENDIX 15.

PRECIPITATION DATA, 1890, FROM SIGNAL SERVICE AND VOLUNTARY OBSERVERS.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890, COMPILED FROM THE REPORTS OF REGULAR SIGNAL SERVICE OBSERVERS, VOLUNTARY AND STATE WEATHER SERVICE OBSERVERS, UNITED STATES POST SURGEONS, OBSERVERS OF THE NEW ENGLAND METEOROLOGICAL SOCIETY, AND OPERATORS AND AGENTS OF THE PACIFIC RAILWAY SYSTEM.

[NOTE.—Letters of the alphabet denote number of days missing from the record; thus "c" indicates that three days are missing. Interpolated values, derived from data for adjacent stations, are given in brackets.]

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Alabama:													
Auburn	2.64	3.36	2.66	1.52	6.18	3.82	4.80	5.84	5.53	7.21	0.16	2.62	46.34
Bermuda	0.15	1.21	2.90	3.00	4.36	0.36	1.25	5.01	2.41	2.96	T.	1.35	24.96
Butler	2.19		4.09	5.12	7.40								
Carrollton			9.67	5.94	5.24	4.42	4.49	8.07	4.93				
Citronelle	1.51	4.28	4.23	3.08	7.47	4.85	5.13	5.13	3.33	4.08	1.40	1.71	46.20
Columbiana	4.41	9.44	6.17	5.17	5.06	5.33	7.68	4.78	6.90	5.56	0.00	1.91	62.41
Decatur[1]	3.28	9.42	3.62	4.72	5.67	2.37	3.32	4.82	3.85	2.37	0.00	2.47	45.91
Decatur[2]	4.47	8.54	4.91	3.15	5.37	2.31	3.05	4.22	5.48	2.06	0.18	[2.47]	[46.21]
Double Springs	5.75	11.42	7.11	5.86	7.39	2.30	[4.00]	4.77	8.63	3.53	1.10	3.97	[65.83]
Elkmont	3.60		6.60	4.40		1.50							
Eufaula				8.93	1.97	10.69	0.51	5.14	3.06	1.00			
Evergreen	1.07	5.11	0.92	1.85	6.08	5.45	7.22	5.83	6.19	5.63	0.05	[1.06]	[46.46]
Florence				3.25		2.42	3.26	7.30	7.87	2.04			
Fort Deposit					e6.09	1.81	4.10	n1.00		1.90	0.03		
Gadsden			5.75	3.52	5.08	2.64						4.46	
Goodwater						2.35	3.25	1.05	3.08				
Greensboro	3.42	[4.50]	5.65	3.16	4.58	2.68	5.38	1.46	8.98	0.91	[1.15]	3.37	[45.24]
Guntersville			6.30	3.32	1.32	1.46	5.16						
Jasper			6.07		3.55	2.08	5.78	4.84	6.59	3.16	0.20	3.53	
Livingston[2]					7.59	3.66	2.36	3.96	5.23	1.99	0.02		
Livingston[3]	1.67	6.72	4.73	3.06	4.15	4.50	3.08	3.71	5.88	2.82	0.67	1.59	42.58

[1] S. S. river station. [2] Cotton belt. [3] Prof. J. W. A. Wright.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Alabama—Continued.													
Marion					3.30	2.85	6.43	1.94	6.54	3.75	0.20		
Mobile	0.60	2.95	2.18	1.98	5.50	4.23	9.22	4.79	3.61	5.58	0.32	1.55	42.51
Montgomery	2.53	3.43	3.93	1.37	10.19	4.57	3.42	4.73	6.03	5.87	0.26	1.85	48.18
Mount Vernon Barracks	1.68	4.35	6.36	4.06	5.38	6.17	5.66	3.84	4.32	5.10	0.47	1.58	48.97
Mount Willing			3.75	1.20	6.65	2.05	5.85		6.65	6.50		1.50	
Opelika					5.55	3.28	4.71	5.75	4.79	7.33	0.09		
Pineapple	1.37	1.49	3.71	T.	5.07	3.60	4.30	0.70	6.26	5.53	[0.92]	[1.55]	[34.50]
Selma					3.92	3.16	2.85	4.05	5.37	2.66	0.00		
Tuscumbia[1]					3.87	5.85	5.01	5.85	6.85	3.00	0.35		
Tuscumbia[2]	6.33		6.79	2.46	3.71	5.04				3.15	0.58	2.61	
Union Springs			2.81	3.28	4.99	3.92	4.10	0.53	6.13	6.55	0.60	0.77	
Uniontown				2.64	3.10	5.92	5.50	4.61	6.84	3.21	1.79	2.47	
Valley Head	3.91	11.61	6.98	3.67	4.78	2.65	7.07	4.71	10.07	3.44	0.35	3.84	63.08
Wiggins	1.07	7.97	3.21	2.25									
Alaska:													
Juneau	3.22	6.55	5.89	4.94	4.85	6.37	5.51	2.21	17.11	11.31	18.46	6.86	93.28
Killisnoo	2.05	4.60	4.20	0.90	2.40	0.30	6.02	1.95	12.80	7.55	8.80	3.00	54.57
Arizona:													
American Flag	2.70	2.60	1.80	0.57									
Antelope Valley	1.83	3.68	3.10	0.00	0.00	T.	2.06	7.80	0.00	2.02	2.70	4.34	27.53
Arizona Canal Co.'s dam	0.10	0.11	0.71	0.40	0.00	0.00	[0.80]	1.80	0.21	0.87	1.85	1.71	[8.56]
Ash Canyon							4.48	5.79	2.04			3.78	
Ash Creek	0.24	0.28	2.40	0.06	T.	0.01	3.30	1.40					
Ash Springs	2.13	0.53	0.17	0.72		0.26	1.57	3.48	2.46				
Bangharts		1.00	6.50	2.50		0.00		3.90	0.55	2.00	0.70		
Benson	1.94	0.00	0.00	0.23	0.00	0.52	[4.00]	4.81	1.44	0.41	0.50	1.48	[15.33]
Bisbee	2.34	0.20	0.24	0.13	0.00	0.03	6.07	5.71	1.73	1.06	0.63	1.99	20.15
Calabasas	2.62	0.38	0.00	0.21	0.00	0.00	[3.04]	[6.70]	[3.50]	0.10	0.50	1.95	[19.00]
Casa Grande	0.30	0.61	0.41	0.38	0.00	0.00	1.38	3.41	0.96	0.38	2.00	0.87	10.70
Chiricahua Mountains	3.80	0.00	0.00	0.89	0.00	0.00	1.18	3.83	2.19	2.85	1.72	2.90	19.36
Chloride	1.60	1.65	0.68	0.70	0.00							2.27	
Cooley Springs	3.20	2.79	1.25	2.38	0.04	0.00	*h*4.63	4.60	1.61	*e*5.78	[1.96]	[2.04]	[30.28]

Cottonwood	1.90	3.90							3.80	3.60	3.80	2.60	
Crittenden							6.00	5.95	2.60	1.42			
Dos Cabezos	1.28	0.29	0.08	0.95	0.00	0.03	3.90	5.07	1.36	1.12	0.42	2.31	16.81
Dragoon	2.11	0.43	0.00	0.32	0.00	0.00	4.09	4.73	2.48	1.01	0.20	2.01	17.38
Dragoon Summit								2.13	2.10	1.41	0.64	0.18	
Dudleyville	1.63	1.46	0.52	0.75	0.00	0.00	2.78	4.07	0.90	0.41	[1.50]	1.67	[16.12]
Eagle Pass	3.03	0.51	0.80	0.79	0.00	T.	3.15	4.70	1.76	1.75	1.34	2.10	19.93
Florence	1.34	[1.20]	0.23	0.68	0.00	0.00	1.83	1.89	0.90	0.41	2.36	2.96	[13.80]
Fort Apache[3]	2.26	2.40	0.82	1.39	T.	T.	5.00	4.44	2.37	2.17	2.85	3.02	26.72
Fort Apache[4]	2.17	1.92	0.75	0.51	0.00	0.00	4.38	4.16	1.34	1.91	2.83	1.52	21.49
Fort Bowie[3]	0.78	0.23	0.03	0.59	0.00	T.	4.85	4.26	2.15	1.60	0.65	2.51	17.65
Fort Bowie[4]	0.78	0.22	0.00	0.70	0.00	T.	4.97	4.06	1.74	1.60	0.61	2.45	17.13
Fort Grant[4]	1.58	0.46	0.46	0.92	0.01	0.20	3.24	4.54	1.36	1.62	0.34	2.01	16.74
Fort Grant[3]	1.58	0.46	0.46	0.92	0.01	0.20	3.23	4.54	0.69	1.62	0.16	2.01	15.88
Fort Huachuca	1.50	0.10	T.	0.34	0.00	T.	4.38	4.49	4.68	0.37	1.04	2.70	19.60
Fort Lowell	2.09	0.55	0.74	0.75	0.00	0.00	6.38	5.58	0.97	0.77	0.83	1.48	20.23
Fort McDowell	0.87	1.33	0.96	0.55	0.00	0.00	1.47	1.55	0.26	1.07	[1.37]	[1.33]	[10.39]
Fort Mojave	2.80	1.10	0.76	0.00	0.00	0.00	0.00	1.50					
Fort Thomas	1.92	0.49	0.45	1.21	0.00	T.	2.02	4.11	0.75	1.30	0.69	0.99	13.93
Fort Verde[3]	1.39	1.97	1.35	0.82	0.01	0.00	1.56						
Fort Verde[4]	1.37	0.48	1.35	0.90	0.00	T.	1.83	2.30	e0.55	[1.50]	[3.65]	[1.72]	[15.65]
Gila Bend[5]	0.00	0.40	0.00	0.00	0.00	0.00	1.40	3.90	0.00	0.00	0.60	1.10	7.40
Gila Bend								1.05	0.23	0.05	0.64	1.42	
Grand Central Mill	1.65	0.00	0.00	0.15	0.00	0.15	2.74	6.48	3.12	0.90	0.28	1.01	16.48
Holbrook	0.60	0.25	0.75	1.01	0.00	0.00	1.32	2.57	1.32	0.62	2.08	1.82	12.34
Lochiel	3.06	0.43	0.02	[0.30]	[0.00]	0.10	4.87	7.18	4.53	0.88	1.11	3.45	[25.93]
Maricopa	0.00	0.22	1.02	0.00	0.00	0.00	0.10	4.29	0.15	0.07	0.31	2.47	8.63
Mount Huachuca	2.51	0.16	0.03	0.32	d0.00	0.00	3.33	4.46	2.25	0.69	1.37	[2.00]	[17.12]
Natural Bridge	4.00	3.50	2.40	1.00	0.01	0.01	2.66	4.16	3.37	1.46	3.50	4.38	30.45
New River	[2.00]	[1.35]	[1.80]	0.37	0.00	0.00	2.30	1.69	0.29	3.27	1.77	4.30	[19.14]
Oro	1.23	0.21	0.48	0.47	0.18	0.00	2.56	4.93	2.04	1.80	0.53	1.51	15.94
Pantano	1.97	0.75	0.15	0.79	0.00	0.00	2.49	6.30	3.97	0.75	0.00	1.54	18.71
Payson	2.44	3.62	2.00	[0.65]	0.00	0.00	[3.00]	[3.25]	2.04	2.06	3.80	4.13	[26.99]
Prescott (Whipple Bks)	2.29	3.02	1.52	0.86	0.00	0.06	2.74	4.02	1.07	p1.60	1.64	2.35	21.17
Red Rock	1.05		0.50	0.25	0.00	0.00				2.90		0.80	
San Carlos	2.10	1.40	0.88	1.11	0.00	0.00	2.25	3.26	0.89	1.22	2.12	2.63	17.86
San Carlos Agency	2.11	1.66	1.03	1.31	0.00	T.	2.29	3.41	0.77	1.32	2.15	2.57	18.62
San Simon	0.84	T.	0.00	0.00	0.00	0.00	1.67	2.46	1.62	0.07	0.50	1.27	8.43

[1] State weather service. [2] Cotton belt. [3] Signal Service. [4] U. S. post surgeon. [5] Daniel Murphy.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Arizona—Continued.													
Show Low	1.85	3.10	0.45	1.40	0.00	0.00	4.28	3.60	1.65	1.10	1.85	2.80	26.13
Signal	0.77	1.31	0.46	0.16	0.00	0.00	0.94	3.17	0.19	1.49	0.46	1.08	10.03
Silver King	3.77	2.93	0.64	2.63	0.00								
Simmons	1.00	0.45	0.23	0.08	0.00	0.00	0.10	1.43	0.13	0.30	0.41	0.44	4.57
Springerville	1.75	0.75	0.25	0.50	0.25	0.50	2.00	2.50	1.00	0.25	1.65	1.45	12.85
Stanton	2.10	2.78	1.43	0.45									
Strawberry	3.35	[2.00]	1.88	0.40	[0.00]	0.18	3.13	3.27	3.19	1.83	2.90	4.99	[27.12]
Tempe	0.87	0.81	0.44	0.33	0.00	0.00	1.75	1.42	T.	0.15	2.06	1.49	9.32
Teviston	3.80	T.	0.20	3.00	0.00	0.00	5.20	4.00	0.12	0.15	0.00	1.70	18.17
Texas Hill	0.00	0.40	0.00	0.00	0.00	0.00	0.10	0.85	0.10	0.03	0.10	1.28	2.86
Tip Top	2.15	6.06	2.41	0.56	0.00	0.00	3.20	2.46	0.41	[0.50]	2.90	4.34	[24.99]
Tombstone					0.00		4.14	6.26	2.96				
Tucson[1]	1.27	0.76	0.29	0.91	0.00	T.	2.37	5.23	1.44	0.62	0.83	1.32	15.04
Tucson[2]	1.22	0.10	0.29	0.10	0.00	0.00	2.37	5.67	1.15	0.65	0.77	1.13	13.45
Walnut Grove	0.70	4.50	1.95	0.30	[0.00]	0.00	2.10	4.65	0.60	1.60	2.45	3.45	[22.30]
Walnut Ranch	1.77	0.08	0.00	0.29	0.00	0.00	5.06	4.89	1.06	2.11	0.41	[2.00]	[17.67]
Willcox[2]	1.61	0.35	0.22	0.63	0.00	0.15	4.68	5.71	2.05	1.03	0.36	1.14	17.93
Wilcox[3]	1.61	0.29	0.11	0.41	0.00	0.14	2.64	5.20	1.97	0.88	0.44	0.00	13.69
Wilgus				1.19		0.00	3.55	5.94	2.20	1.25	0.63	2.80	
Wood Cañon	2.70	0.90	0.00	1.00				3.63	5.80	0.00		5.00	
Woodruff	2.30	0.60	1.60	0.60	0.00	[0.00]	[1.50]	[3.00]	1.80	0.50	1.70	2.00	[15.60]
Yuma[4]	T.	0.86	T.	T.	0.00	0.00	T.	0.83	0.64	1.70	0.12	0.52	4.67
Yuma[3]	T.	0.86	0.00	0.00	0.00	0.00	0.00	1.67	0.64	1.70	0.12	0.52	5.51
Arkansas:													
Arkansas City	7.12	5.58	6.88	7.29	6.73	4.35	1.98	1.68	5.40	3.47	2.80	5.85	59.13
Brinkley					4.78	4.78	2.58				2.80		
Camden	7.57	6.54	4.02	7.97	4.77	8.15	T.	2.66	7.21	4.46	2.85	3.78	59.98
Conway	6.13	11.08	10.46	12.18	6.50	3.81	3.34	3.98	10.31	2.57	4.71	2.63	77.70
Dallas		4.95	4.07	11.55	9.10	4.22	3.05					2.20	
Dardanelle	6.49	10.23	7.30	15.00	6.52	4.35	2.60	4.35	9.60	3.40	3.50	3.30	76.64
Devalls Bluff					5.48	5.42	3.10	1.17	5.35	2.05	5.16	4.25	
Forrest City	7.65	7.09	8.45	7.93	6.26	2.68	2.24	3.44	7.34	2.01	6.54	3.44	65.07

Fort Smith	3.97	6.27	5.99	8.17	5.36	3.02	2.71	10.89	7.23	2.83	5.60	2.59	64.63
Fulton	7.81	5.75	2.74	10.22	3.49	6.03	0.70	0.54	3.31	1.48	3.37	0.58	46.02
Harrisburg	7.22	8.47	6.68	8.39	4.43	2.89	[1.70]	[4.00]	5.50	3.18	7.10	4.46	[64.02]
Heber	5.71			5.10	4.55	3.80							
Helena[3]	10.13	9.30	7.47	8.55	5.80	3.03	4.39	4.83	9.64	4.17	3.51	4.36	75.18
Helena[5]					4.73	4.61	2.57	4.23	8.99	3.26	3.24	3.73	
Hot Springs	6.39	5.91	9.03	12.95	6.36	9.72	4.18	3.83	12.62	2.25	5.00	2.61	80.85
Lead Hill	7.37	5.32	6.78	5.71	4.08	2.18	1.84	5.73	12.08	2.28	3.38	2.15	58.90
Little Rock	8.48	6.48	5.79	7.77	6.16	8.28	1.83	2.59	5.55	2.75	5.21	2.83	63.72
Little Rock Barracks[2]	9.72	6.42	6.35	8.44	6.39	9.90	3.71	1.90					
Lonoke	8.35	5.20	]6.00]	11.88	3.68	6.06	4.34	1.62	5.72	1.75	4.19	2.75	[62.44]
Malvern					3.70	1.64	0.08	0.15		0.18?	5.14		
Newport	8.24	12.59	8.59	10.41	4.21	2.93	1.68	4.96	6.56	2.26	6.03	3.69	72.15
Newport[5]					4.12	2.98	1.37	4.63	7.25	2.56	5.85	3.55	
Osceola	[8.00]	7.73	6.76	5.93	6.24	3.12	6.07	5.27	5.54	2.91	5.06	4.71	[67.34]
Ozone	9.46	7.40	8.91	12.83	9.65	2.58	8.43	6.49	9.00	2.63	5.00	3.10	85.48
Pine Bluff	5.08	8.35	5.10	4.73	5.73	5.55	0.66	0.78	4.44	1.48	4.51	2.88	49.29
Prescott					8.18	5.32	0.37	1.66	5.90	3.09	4.09		
Russellville					4.36	4.56	3.52	6.47	8.78	2.74	3.70	2.21	
Stuttgart	7.64	7.17	9.07	7.73	6.00	3.48	3.09	2.43	5.22	2.56	5.15	4.38	63.92
Texarkana	4.35	5.82	4.05	7.95	6.42	5.76	0.00	0.76	4.31	3.09	3.78	1.70	47.99
Washington	9.21	6.09	3.91	10.34	9.27	4.72			4.07	3.55			
Winslow	5.26	5.01	5.26	7.52	6.57	4.82	0.51	10.52	8.26	3.13	4.22	5.12	66.20
California:													
Alcalde	4.10	5.93	[1.50]	0.00	0.00	0.00	0.00	0.00	1.60	0.00	0.00	1.52	[14.65]
Alcatraz Island	10.66	4.42	4.93	1.45	0.64	0.00	0.00	0.00	T.	0.00	0.12	1.11	23.33
Almaden	10.90	5.92	3.74	0.65	1.35	0.00	0.00	0.00	0.07	0.00	0.04	2.92	25.59
Anaheim	3.36	1.54	0.78	0.00	T.	0.00	0.00	0.00	0.29	0.00	0.19	3.36	9.52
Anderson	10.56	5.93	8.29									4.15	
Angel Island	6.95	4.07	4.87	1.26	1.20	0.00	0.00	0.00	0.20	0.00	0.00	1.00	19.55
Antioch	5.16	2.97	2.45	0.31	0.54	0.00	0.00	0.00	0.93	0.04	0.00	1.32	13.92
Aptos	10.29	4.60	3.16	[2.00]	1.66	0.00	0.00	0.00	0.40	0.40	0.28	2.93	[25.72]
Arcata	16.85	14.78	11.94	2.26	2.05	1.18	[0.00]	[0.15]	0.92	0.45	0.22	4.84	[55.64]
Athlone	3.14	1.19	1.79	0.54	0.72	0.00	0.00	0.00	1.61	0.00	0.24	1.97	11.20
Auburn	8.97	3.96	8.08	2.83	2.30	0.00	0.00	0.00	2.63	0.14	0.00	5.13	34.04
Bakersfield	1.20	0.16	0.24	0.00	0.06	0.00	0.00	0.03	0.47	0.00	0.00	1.34	3.50
Barstow	0.36	0.15	T.	0.07	0.00	0.00	0.00	0.15	0.59	0.00	0.05	0.52	1.89
Beaumont	3.71	4.74	1.13	1.15	0.05	0.00	0.15	0.15	1.04	0.00	0.43	2.74	16.29

[1] E. L. Wetmore. [2] U. S. post hospital. [3] Pacific Railway system. [4] Signal Service. [5] Cotton belt.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
California—Continued.													
Benicia Barracks	7.35	4.85	4.01	1.04	0.88	T.	0.00	0.00	1.30	0.00	T.	3.35	22.78
Berendo	2.48	0.73	1.37	0.65	0.64	0.00	0.00	0.00	2.00	0.00	0.03	2.83	10:73
Berkeley	11.16	5.70	4.74	2.18	1.44	0.00	0.00	T.	0.25	0.00	0.00	3.32	28.79
Bishop Creek	4.75	0.30	0.00	[0.00]	0.00	0.00	0.00	0.50	0.69	0.00	0.00	1.00	[7.06]
Boca	14.60	5.40	5.45	[0.50]	0.70	[0.00]	0.00	0.00	0.00	0.70	0.00	3.65	[31.00]
Borden	[2.00]	0.79	1.15	0.26	0.51	0.00	0.00	0.00	0.00	0.00	0.10	2.40	[7.21]
Boulder Creek	29.40	10.62	11.77	2.29	1.60	0.00	0.00	0.00	0.30	0.00	0.25	9.45	65.68
Brentwood	5.29	3.35	2.32	0.92	0.37	[0.00]	0.00	0.00	1.50	0.02	0.00	1.56	[15.33]
Brighton	5.00	2.06	2.70	1.45	1.40	0.00	0.00	0.00	1.10	0.00	0.00	3.03	16.74
Byron	6.44	2.35	2.16	0.38	[0.75]	0.00	0.00	0.00	1.63	0.00	0.00	[2.00]	[15.71]
Caliente	[10.00]	1.15	1.10	0.00	1.62	0.00	0.00	0.00	0.52	0.00	0.00	4.30	[18.69]
Calistoga	18.00	4.78	9.16	2.25	[2.00]	0.00	0.00	0.00	0.10	0.00	0.00	4.85	[41.14]
Campo	2.40	7.25	1.69	------	0.90	------	2.26	2.67	1.80	------	0.95	------	------
Castroville	7.87	3.33	1.89	0.57	0.67	0.00	0.00	0.00	0.59	0.00	0.19	2.08	17.19
Centerville	7.18	3.63	3.03	1.12	1.08	0.00	0.00	0.00	e0.45	e0.00	0.00	3.05	19.54
Chico	5.26	2.51	5.65	1.97	1.87	0.00	0.00	0.00	1.28	0.00	0.00	3.24	21.78
Cisco	22.90	14.90	8.70	1.50	2.50	0.30	0.00	0.00	3.11	0.55	0.00	7.90	62.36
Colegrove	6.75	1.33	0.68	0.21	0.08	0.00	0.00	0.00	0.07	0.10	0.11	2.72	12.05
Colfax	17.90	8.00	14.70	3.95	3.85	0.00	0.00	0.00	2.75	.T	0.00	4.34	55.49
Colton	2.94	1.15	0.50	0.00	0.00	0.00	0.00	0.06	0.67	0.00	0.19	2.45	7.96
Colusa	6.27	3.03	4.08	1.48	2.15	1.25	0.00	0.04	0.77	0.00	0.00	2.94	22.01
Corning	?	2.28	4.56	1.25	2.34	0.00	0.00	0.00	0.78	0.00	0.00	2.26	------
Crescent City	24.98	23.49	13.51	4.07	0.52	3.27	0.33	0.06	0.42	1.11	0.08	9.66	81.50
Davisville	6.36	3.69	3.35	1.60	2.21	0.00	0.00	[0.00]	0.62	0.00	0.00	5.28	[23.11]
Delano	[5.00]	0.62	0.42	0.08	0.61	0.00	0.00	0.00	0.52	0.00	0.19	1.31	[8.75]
Delta	17.18	21.11	16.50	4.78	2.33	0.00	0.00	0.00	1.00	0.40	0.00	7.24	70.54
Downey	4.68	1.51	0.77	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.22	[2.00]	[9.22
Dunnigan	7.22	3.62	3.90	1.16	1.91	0.00	0.00	0.00	0.64	0.00	0.00	3.18	21.63
Dunsmir	23.60	16.50	[4.00]	11.85	2.45	0.40	0.00	0.05	0.90	0.00	0.00	8.05	[67.80]
East Brother light-house	3.45	2.55	1.92	0.37	0.83	0.00	0.00	0.00	0.05	0.00	0.00	1.55	10.72
Edgewood	5.60	[6.00]	5.04	0.70	1.60	1.72	[0.85]	0.45	1.05	0.22	0.00	[2.00]	[25.23
El Dorado	12.48	5.67	10.04	3.00	3.45	0.00	0.00	[0.00]	1.77	0.10	0.00	5.48	[41.99]

Elmira	8.68	4.08	5.26	1.05	1.86	0.00	0.00	0.00	0.35	0.00	0.00	3.74	25.02
El Verano	14.27	5.84	6.94	1.64	1.39	0.00	0.00	0.00	0.10	0.00	0.00	5.19	35.37
Emigrant Gap	16.90	9.80	13.15	1.72	3.37	0.00	0.00	0.00	0.32	0.65	0.00	6.20	52.11
Esparto	------	------	------	------	1.58	0.00	0.00	0.02	0.41	0.00	0.43	2.85	------
Esperanza	8.58	3.98	3.05	0.83	------	------	------	------	------	------	------	------	------
Eureka	18.26	13.88	11.57	2.26	1.71	0.87	0.08	0.02	0.79	0.44	0.18	5.48	55.54
Evergreen	6.30	4.86	1.95	0.74	1.50	0.00	0.00	0.00	0.31	0.00	0.15	2.60	18.41
Farallon light-house	6.35	1.85	3.80	0.82	1.10	0.00	0.00	0.00	0.00	0.00	0.00	1.26	15.18
Farmington	[4.52]	1.87	1.78	1.37	1.14	0.00	0.00	0.00	0.63	0.00	0.00	1.96	[13.27]
Felton	21.36	7.11	10.00	3.29	1.64	0.00	0.00	0.00	0.35	0.00	0.12	6.35	50.22
Florence	5.01	1.13	[0.55]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	2.57	[9.39]
Folsom	7.67	5.26	5.68	2.09	2.29	0.00	0.00	0.00	1.58	0.03	0.00	4.65	29.25
Fort Bidwell	7.45	3.97	3.97	0.92	1.07	0.33	0.05	0.05	1.60	[0.10]	[0.00]	[1.00]	[20.51]
Fort Gaston	18.29	15.58	10.68	2.94	1.57	0.46	0.00	T.	0.60	0.54	0.13	7.19	57.98
Fort Mason	8.20	4.47	4.76	1.22	1.02	0.06	0.03	0.02	0.12	0.00	0.04	3.48	23.42
Fort Ross	12.44	3.75	9.87	3.44	1.51	0.13	0.00	0.00	0.19	0.10	0.00	6.21	37.64
Fresno City[1]	2.12	0.80	1.04	0.17	0.45	0.00	0.00	T.	1.26	0.00	0.22	2.30	8.36
Fresno City	2.16	0.65	0.92	0.29	0.25	0.00	0.00	0.00	1.00	0.00	0.25	2.11	7.63
Fruto	7.58	1.94	3.28	0.81	2.11	[0.25]	0.00	0.00	0.95	0.00	0.00	3.01	[19.93]
Galt	6.83	3.31	[1.80]	[1.25]	1.87	0.00	0.00	0.00	0.83	0.00	0.00	3.08	[18.97]
Georgetown	19.90	8.96	14.70	3.86	4.66	0.10	0.00	0.00	2.81	0.19	T.	7.65	62.83
Gilroy	10.50	5.62	1.89	0.64	0.55	0.00	0.00	0.00	0.20	0.00	0.10	3.84	23.34
Girard	3.05	1.20	0.25	0.40	1.05	0.00	0.00	0.00	0.08	0.00	0.05	3.30	10.75
Glen Ellen	19.28	7.49	9.84	2.21	1.85	0.00	[0.00]	1.37	0.06	0.06	0.00	6.23	[47.02]
Goshen	2.08	1.13	0.69	0.32	0.17	0.00	0.00	0.00	0.80	0.00	0.43	2.01	7.63
Grass Valley[1]	18.01	8.27	14.02	3.69	3.44	0.06	0.00	T.	2.09	0.05	0.00	5.86	55.49
Grass Valley[2]	18.64	10.02	13.69	3.52	3.10	0.02	0.00	0.00	1.95	0.00	0.00	4.42	55.36
Haywards	8.68	3.99	3.36	1.31	1.01	0.00	0.00	0.00	0.38	0.00	0.00	2.65	21.38
Hollister	5.70	2.15	1.45	0.52	0.31	0.00	0.00	0.00	0.45	0.00	0.05	2.51	13.14
Hornbrook	6.00	9.91	0.70	[0.45]	0.44	0.60	0.85	0.46	0.00	0.00	0.00	1.90	[21.31]
Humboldt L. H	16.34	12.87	11.76	2.39	1.16	0.92	0.00	0.00	1.11	0.02	0.43	5.62	52.62
Hydesville	17.31	10.13	8.62	1.63	1.58	0.67	0.15	0.00	1.51	0.04	0.49	5.85	47.98
Indio	[0.75]	0.06	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.00	0.00	0.22	[1.33]
Ione	4.94	3.75	4.87	2.50	2.05	0.00	0.00	0.00	0.72	0.00	0.00	3.49	22.32
Iowa Hill	20.87	10.74	14.12	3.02	3.48	0.08	0.00	T.	2.29	0.35	0.00	7.34	62.29
Jolon	6.58	4.59	2.50	0.05	0.30	0.00	0.00	0.03	0.90	0.00	0.57	2.25	17.77
Julian	6.12	10.39	3.63	1.11	2.54	0.00	0.00	1.25	1.25	0.00	2.00	6.36	34.65
Keeler[1]	0.42	0.01	T.	0.10	0.20	0.00	T.	1.71	0.93	0.03	0.12	0.22	3.74

[1] Pacific Railroad System.

[2] Mr. W. Loutzenheiser.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
California—Continued.													
Keeler[1]	0.42	[0.01]	[0.24]	0.00	0.14	0.00	0.00	1.30	0.40	0.02	0.12	0.16	[2.82]
Keene	3.15	1.97	1.98	0.50	1.30	0.00	0.00	1.40	0.41	0.00	0.10	3.57	14.38
King City	4.34	3.01	1.13	0.00	0.13	0.00	0.00	0.00	0.97	0.00	0.12	1.54	11.24
Kingsburg	2.81	1.43	0.83	0.42	0.57	0.00	0.00	0.00	0.56	0.00	0.00	1.92	8.54
Knights Landing	4.80	4.18	3.37	1.02	1.93	0.00	0.00	0.00	0.40	0.00	0.00	2.37	18.07
La Grange	5.17	3.77	2.13	1.45	1.42	0.00	T.	T.	0.95	T.	0.18	2.93	18.00
Lathrop	4.30	2.15	1.67	0.63	0.34	0.00	0.00	0.00	0.70	0.00	0.00	1.75	11.54
Laurel	24.72	9.10	7.40	2.52	2.50	0.00	0.00	0.00	0.00	0.00	0.02	7.52	53.78
Lemoore	1.23	0.86	0.51	0.22	0.22	0.00	0.00	0.00	1.80	0.00	0.00	1.47	6.31
Lewis Creek	5.02	1.09	1.40	T.	0.55	0.00	0.00						
Livermore	5.24	3.71	2.85	0.86	0.48	0.00	0.00	0.00	1.20	0.00	0.00	3.31	17.65
Livingston	4.47	1.61	0.89	0.73	0.33	0.00	0.00	0.00	1.71	0.00	0.03	[2.00]	[11.77]
Lodi	6.67	2.90	2.71	1.94	1.20	0.00	0.00	0.00	0.99	0.00	0.00	3.65	20.06
Los Angeles[2]	7.83	1.36	0.66	0.22	0.03	0.02	0.00	0.03	0.06	0.03	0.13	2.32	12.69
Los Angeles[1]	8.41	1.49	0.68	0.15	0.07	0.00	0.00	0.00	0.08	0.02	0.15	2.82	13.87
Los Banos	2.42	1.46	0.91	[0.50]	[0.50]	[0.00]	0.00	0.02	1.24	0.00	0.16	1.32	[8.53]
Los Gatos[2]	15.68	7.12	4.92	1.03	1.34	0.00	0.00	0.00	0.20	0.00	0.00	4.07	34.36
Los Gatos[3]	16.45	7.83	5.27	1.25	1.30	0.00	0.00	T.	0.19	0.00	0.03	4.74	37.06
Mammoth Tank	0.00	0.54	0.00	0.00	0.00	0.00	0.10	0.00	0.12	0.30	0.00	0.54	1.60
Martinez	8.83	6.00	3.52	0.86	0.74	0.00	0.00	0.00	1.08	0.00	0.00	2.72	23.75
Marysville[2]	4.44	4.65	6.71	1.85	2.55	0.10	0.00	0.00	0.73	[0.00]	[0.00]	2.62	[23.65]
Marysville[3]	5.59	4.71	4.78	1.83	2.44	0.09	0.00	0.00	0.91	0.00	0.00	2.95	23.30
Mendocino	12.41	6.98	8.15	3.46									
Menlo Park	7.45	3.27	2.76	0.51	1.48	0.00	0.00	0.00	0.18	[0.00]	0.00	2.61	[18.26]
Merced	4.40	1.50	1.01	0.39	0.51	0.00	0.00	0.00	1.73	0.00	0.00	[2.00]	[11.54]
Modesto	3.95	1.03	0.88	0.63	0.59	0.00	0.00	0.00	1.27	0.02	0.00	2.14	10.51
Mojave	0.85	0.58	0.00	0.00	[1.00]	0.00	0.00	0.00	0.70	[0.00]	0.15	0.67	[3.95]
Monson						0.00	0.00	0.00	0.70	0.00	0.27	2.60	
Montague	3.70	6.05	3.60	0.33	0.82	1.15	0.00	0.35	0.90	0.00	0.00	1.40	18.30
Monterey	7.67	2.67	0.83	0.34	0.37	0.00	0.00	0.00	0.10	0.00	1.32	2.66	15.96
Mount Hamilton	7.93	6.60	4.39	1.79	2.42	0.00	0.00	0.00	0.80	0.02	0.58	5.39	29.92
Napa City[2]	9.86	6.59	6.42	2.08	1.91	0.00	0.00	0.00	0.39	0.00	0.00	3.41	30.66

Napa City[4]	9.40	6.36	5.46	1.68	2.23	0.00	0.00	T.	0.43	0.00	0.00	4.13	29.69
National City	2.22	2.73	0.64	0.13	0.41	0.00	0.00	0.07	0.87	0.00	0.93	2.43	10.43
Newark	6.28	3.34	2.26	0.85	1.05	0.00	0.00	0.00	0.10	0.00	0.00	2.55	16.44
Newhall	6.30	4.41	0.44	0.33	[0.00]	0.00	0.00	0.00	0.35	0.00	0.00	1.94	[13.77]
Newman	4.56	3.25	0.80	0.70	0.20	0.00	[0.00]	0.00	1.31	0.00	0.00	1.17	[11.99]
Niles	7.20	3.42	3.00	1.16	1.12	0.00	0.00	0.00	0.44	0.00	0.07	2.18	18.59
North Hill Vineyard (near Milton)	5.74	2.33	2.29	1.33	2.43	0.00	0.00	0.00	0.50	T.	T.	2.62	17.24
Norwalk	3.32	1.08	0.45	0.13	0.05	0.03	0.00	0.00	0.08	0.00	0.19	2.01	7.34
Oakland[5]	10.22	5.72	3.52	1.51	1.17	T.	T.	T.	0.10	0.00	0.00	3.91	26.15
Oakland[6]	9.99	5.45	3.65	1.18	1.01	0.00	0.00	0.00	0.87	0.00	0.69	2.96	25.11
Ogilby	[0.00]	[0.54]	[0.00]	0.00	0.02	0.00	0.05	0.00	0.00	0.14	0.02	0.31	[1.08]
Ontario	5.53	2.03	1.25	0.01	[0.41]	0.00	0.00	0.16	0.18	0.16	0.34	2.00	[12.07]
Orland	3.29	1.63	3.59	0.53	1.75	0.00	0.00	0.00	[1.00]	0.00	0.00	2.46	[14.25]
Oroville	[4.00]	5.95	7.07	2.47	3.84	0.45	0.00	0.00	[1.00]	0.00	0.75	4.61	[30.14]
Pajaro	9.08	5.11	2.13	0.69	0.47	0.00	0.00	0.00	0.21	0.00	0.37	3.54	21.60
Pasadena	6.83	2.83	.72	0.54	0.29	0.05							
Paso Robles	6.75	5.40	1.74	0.03	0.22	0.00	0.00	0.00	0.65	0.00	0.30	3.34	18.43
Petaluma	10.05	4.90	4.94	1.24	1.29	0.00	0.00	0.07	0.08	0.00	0.00	3.08	25.65
Placerville[2]	16.17	6.60	13.16	3.51	3.61	0.00	0.00	0.00	1.40	0.00	0.02	7.54	52.01
Placerville[7]	14.57	7.46	12.94	3.51	4.01	0.00	0.00	T.	1.64	T.	T.	6.89	51.02
Pleasanton	6.05	2.93	[2.30]	2.24	0.37	0.00	0.00	0.00	0.62	0.00	0.00	2.77	[17.28]
Point Año Nuevo L. H	9.05	2.10	2.25	1.00	1.30	0.00	0.00	0.00	0.00	0.00	0.00	2.77	18.47
Point Arena L. H	11.20	4.57	6.58	2.64	1.56	0.00	0.00	0.00	0.50	0.25	0.12	4.05	31.47
Point Boneta L. H	9.74	4.41	4.45	1.42	1.08	0.17	0.00	0.00	0.00	0.00	0.00	3.59	24.86
Point Concepcion L. H	5.05	4.31	1.05	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.50	2.26	13.52
Point Montara L. H	6.60	3.49	4.14	1.53	1.12	0.00	0.00	0.00	0.05	0.00	0.00	2.46	19.39
Point Reyes L. H	9.00	3.75	6.79	1.79	2.12	0.00	0.00	0.00	0.00	0.00	0.00	1.37	24.82
Point Reyes Light[3]	8.98	3.75	6.69	1.79	2.12	0.06	0.43	0.24	0.07	T.	0.07	1.37	25.57
Pomona	3.50	2.65	[.50]	0.00	0.00	0.00	0.00	0.00	0.87	0.04	0.32	2.27	[10.15]
Porterville	3.43	.49	1.30	0.12	0.20	0.00	0.00	0.15	0.00	0.00	0.40	2.78	8.87
Presidio of San Francisco	11.06	4.54	9.28	1.42	1.44	0.08	0.00	[0.00]	0.05	[0.00]	0.00	4.75	[28.62]
Puente	6.78	2.70	.78	0.00	0.02	0.00	0.00	0.00	0.38	0.00	0.01	0.00	10.67
Ravenna						0.00	0.00	0.00	0.73	0.00	0.27	0.00	
Red Bluff[8]	6.55	3.67	6.14	1.70	2.67	0.11	0.00	0.00	1.55	0.01	0.00	3.10	25.50
Red Bluff[2]	6.77	3.28	6.37	1.62	2.34	0.00	0.00	0.00	2.03	0.00	0.00	2.04	24.45
Redding	10.80	6.76	7.77	3.12	2.24	0.00	0.00	0.00	1.57	0.00	0.00	3.56	35.82
Riverside	4.28	1.76	.55	0.06	0.17	0.00	0.00	0.55	0.71	0.07	0.33	3.07	11.55

[1] Mr. W. Loutzenheiser.
[2] Pacific Railway System.
[3] F. H McCullagh.
[4] W. H. Martin.
[5] Chabot Observatory.
[6] Appeal office.
[7] R. Rowland.
[8] Signal Service.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
California—Continued.													
Rocklin	6.47	3.01	4.54	2.15	1.78	0.00	0.00	0.00	0.96	0.00	0.00	3.78	22.69
Rumsey	12.01	4.52	5.32	1.17	1.29	0.00	0.00	0.00	0.35	0.00	0.00	3.91	28.57
Sacramento[1]	6.62	4.06	3.00	1.33	1.80	0.00	0.00	T.	0.80	T.	0.00	3.34	20.95
Sacramento[2]	7.44	4.02	3.73	1.34	2.10	0.00	0.00	T.	1.42	0.01	T.	3.72	23.78
Sacramento[3]	5.32	2.95	2.49	1.12	1.60	0.00	0.00	0.00	0.90	0.00	0.00	2.64	17.02
Salinas	6.19	3.03	1.79	0.60	0.65	0.00	0.00	T.	0.29	0.00	0.44	2.05	15.04
Salinas[3]	7.31	2.74	1.80	0.56	0.52	0.00	0.00	0.00	0.25	0.00	0.59	2.26	16.03
Salton	[2.00]	[1.00]	[0.00]	0.00	0.00	0.00	0.60	0.37	1.35	0.00	0.00	0.32	[5.64]
San Ardo	3.36	3.59	0.99	0.00	0.43	0.00	0.00	0.04	1.10	0.00	0.11	1.41	11.03
San Bernardino	5.15	2.40	0.89	0.00	0.31	0.00	0.13	2.16	0.88	0.58	1.27	3.02	16.79
San Diego[1]	2.79	1.70	0.41	0.05	0.08	0.00	0.00	T.	0.65	0.01	0.72	1.61	8.02
San Diego[4]	1.98	2.11	0.40	0.05	0.24	0.00	0.00	T.	0.64	0.02	0.75	1.64	7.83
San Fernando	5.40	2.72	0.53	0.05	0.10	0.00	0.00	0.00	0.36	0.00	0.18	1.61	10.95
San Francisco	9.61	5.16	4.73	1.18	1.07	0.10	0.02	0.00	0.31	0.00	0.00	3.25	25.43
San Gabriel	7.43	1.77	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	1.68	11.80
Sanger Junction	4.02	1.48	1.22	0.11	0.00	0.00	0.00	0.00	0.11	0.00	0.04	2.37	9.35
San José	6.52	3.64	2.08	0.55	0.75	0.00	0.00	0.00	0.05	0.00	0.05	2.40	16.04
San Mateo	8.69	4.39	3.94	0.79	0.58	0.00	0.00	0.00	0.10	0.10	0.00	2.86	21.45
San Miguel	3.79	3.13	0.81	0.00	0.18	0.00	0.00	0.00	0.67	0.00	0.01	[3.00]	[11.59]
San Pedro	3.10	1.56	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	1.01	6.51
Santa Ana	4.75	1.66	3.22	0.00	0.35	0.00	0.00	0.00	0.25	0.00	0.30	2.35	12.88
Santa Barbara[5]	5.32	2.96	1.10	0.31	0.18	0.06	0.00	0.00	1.50	0.05	0.48	3.53	15.49
Santa Barbara[3]	5.49	3.38	0.95	0.25	0.13	0.00	0.00	0.00	1.97	0.00	0.50	3.02	15.69
Santa Clara	7.02	3.35	1.99	0.47	0.73	0.00	[0.00]	[0.00]	0.10	[0.00]	0.07	2.07	[15.80]
Santa Cruz[3]	9.40	4.90	5.58	1.06	1.22	0.00	0.00	0.00	0.80	0.00	0.00	2.34	25.30
Santa Cruz						0.00		0.00	0.30	0.00	0.02	2.78	
Santa Margarita	8.53	7.72	3.49	0.00	0.32	0.00	0.00	0.00	0.85	0.00	0.00	5.68	26.59
Santa Maria	7.02	3.64	0.88	0.10	0.13	0.00	0.06	0.00	0.55	0.70	0.70	3.40	17.18
Santa Monica	[7.00]	2.03	0.94	0.00	0.00	0.00	0.00	0.00	0.60	0.09	0.36	2.81	[13.83]
Santa Paula	5.40	2.00	0.47	[0.00]	0.00	0.00	0.00	0.00	0.72	0.00	0.34	2.53	[11.46]
Santa Rosa	12.84	4.74	6.15	1.82	1.40	0.00	0.00	0.00	0.20	0.00	0.00	3.93	31.08
Selma	2.19	0.94	1.19	0.25	1.19	0.00	0.00	0.00	0.95	0.00	0.50	1.89	9.10

Seven Palms	0.52	0.10	[0.50]	0.00	0.00	0.00	0.00	0.25	0.38	0.00	0.00	0.50	[2.25]
Shingle Springs	13.50	6.70	10.48	[1.30]	2.75	0.00	0.00	0.00	1.50	0.08	0.00	5.40	[41.71]
Sims	17.85	18.30	19.83	5.53	2.64	0.65	0.00	0.00	1.44	0.00	0.00	8.80	75.04
Sisson	[9.00]	9.33	5.30	2.98	2.75	[0.50]	0.00	0.00	1.20	0.13	0.00	3.18	[34.37]
Soledad	3.79	2.53	0.37	0.00	0.04	0.00	0.00	0.00	0.65	0.00	0.27	1.94	9.59
Sonoma	12.87	c6.02	6.16	1.80	d1.12	T.	0.00	0.04	0.23	0.03	0.00	3.73	32.00
South Side	3.20	3.35	0.40	0.00	0.00	----	----	----	----	----	----	----	----
South Vallejo	[10.00]	3.73	3.73	[2.00]	1.01	0.00	0.00	0.00	0.00	0.00	0.47	3.16	[24.10]
Spadra	4.52	1.59	0.75	0.00	0.03	0.00	0.00	0.00	0.40	0.00	0.25	2.00	9.54
Steeles	6.45	4.66	2.96	0.30	0.40	0.00	0.00	0.00	0.91	0.00	0.46	3.45	19.59
Stockton[6]	4.99	1.66	1.26	1.08	0.55	----	----	----	----	----	----	----	----
Stockton[3]	4.80	1.98	1.76	1.21	0.65	0.00	0.00	[0.00]	0.60	[0.00]	0.00	[1.80]	[12.80]
Summit	19.20	11.60	14.00	2.60	[0.80]	0.00	0.00	0.00	0.00	0.00	0.00	7.40	[55.60]
Suisun	7.38	4.50	5.46	1.10	1.02	0.00	0.00	0.00	0.33	0.00	0.00	2.81	22.60
Susanville	8.72	4.71	4.60	1.06	1.51	0.14	0.00	0.15	0.15	T.	0.35	3.47	24.86
Tehachapi	1.75	0.70	0.30	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	3.48	6.73
Tehama	4.68	1.05	3.79	0.75	1.45	0.00	0.00	0.00	0.00	0.00	0.00	2.88	14.60
Templeton	6.55	5.83	2.07	0.16	0.22	0.00	0.00	0.00	0.00	0.00	0.27	4.24	19.34
Tracy	4.76	1.98	1.56	0.97	0.19	0.00	0.00	0.00	1.45	0.00	0.00	1.83	12.74
Traver	2.55	1.10	1.12	0.35	0.81	0.00	0.00	0.00	0.80	0.00	0.63	2.85	10.21
Tropico	[6.00]	4.16	0.45	0.04	0.00	0.00	0.00	0.00	0.23	0.10	0.00	3.13	[14.11]
Truckee	16.20	8.90	7.29	0.45	1.44	0.00	0.00	0.22	0.80	0.45	0.00	3.70	39.40
Tulare	2.75	0.74	0.81	0.22	0.20	0.00	0.00	0.00	0.72	0.00	0.33	2.45	8.22
Turlock	3.22	1.18	0.71	0.80	0.53	0.00	0.00	0.12	1.45	0.00	0.03	1.64	9.68
Upper Mattole	33.40	20.36	17.83	4.38	0.40	0.74	0.07	T.	1.52	0.81	0.67	9.88	90.06
Vacaville[7]	12.37	5.71	5.98	1.22	1.63	0.00	0.00	T.	0.34	T.	T.	4.14	31.39
Vacaville[3]	11.74	5.49	5.74	0.96	1.40	0.00	0.00	0.00	0.28	0.04	0.00	2.92	28.57
Valley Springs	7.28	3.62	5.03	1.75	2.35	0.00	0.00	0.00	1.20	0.00	0.00	3.07	24.30
Vina	6.05	3.58	4.26	0.00	2.11	0.00	0.00	0.00	0.51	0.00	0.00	2.21	18.72
Visalia	3.34	1.12	1.10	0.25	0.46	0.00	0.00	0.00	0.73	0.00	0.51	2.36	9.87
Volcano Springs	0.09	0.68	0.00	0.03	[0.00]	0.00	0.03	0.07	0.00	0.00	0.00	0.47	[1.37]
Volta (Los Banos)	3.11	1.03	0.75	0.02	0.33	0.00	0.00	0.00	1.20	0.00	0.15	0.97	7.56
Walla Walla Creek	11.86	9.10	4.93	1.24	1.29	0.28	0.00	0.85	1.84	0.10	0.19	3.85	35.53
Walnut Creek	7.77	4.68	3.59	0.42	0.45	0.00	0.00	0.00	0.77	0.00	T.	2.70	20.38
West Butte	5.45	2.59	4.14	1.59	2.02	0.23	0.00	0.04	0.87	0.00	0.00	2.49	19.42
Westley	3.48	1.69	0.89	1.13	0.33	0.00	0.00	0.00	0.00	0.00	0.00	1.75	9.27
Wheatland	4.45	4.17	4.45	1.40	1.84	0.00	0.00	T.	1.01	T.	----	2.19	19.51

[1] Signal Service.
[2] S. H. Gerrish.
[3] Pacific Railway System.
[4] United States post hospital.
[5] Hugh D. Vail.
[6] W. W. Trivett.
[7] G. O. Coburn.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
California—Continued.													
Whittier	5.13	1.58	0.50	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.15	1.60	9.15
Williams	3.20	2.90	3.30	0.65	1.77	0.00	0.00	0.00	0.75	0.00	0.00	1.79	14.36
Willows[1]	4.52	2.70	4.74	0.62	1.89	0.20	0.00	T.	0.68	0.00	T.	3.14	19.49
Willows[2]	15.36	1.98	3.85	0.62	0.55	0.00	0.00	0.00	0.00	0.00	0.00	3.45	15.81
Winters	12.17	5.03	4.63	0.97	1.48	0.00	0.00	0.00	0.23	0.00	0.00	3.71	28.22
Woodland[1]	5.10	2.40	3.35	1.00	1.60	0.00	0.00	0.00	0.60	0.00	0.00	2.35	16.40
Woodland[2]	5.30	4.37	3.42	0.95	1.68	0.00	0.00	0.00	0.42	0.00	0.00	3.04	19.18
Yerba Buena L. H	0.66	4.42	4.67	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	21.85
Colorado:													
Abbott	[0.30]	[0.22]	0.18	3.02	1.13	1.00	1.09	2.11	0.30	0.50	0.15	0.00	[10.00]
Agate	0.40	0.50	T.	4.25		0.62				0.00	0.00		
Alma	[1.00]	[1.00]	3.18	4.35	0.12	0.07	3.68	2.29	0.04	0.84	0.50	0.00	[18.07]
Amherst						1.02	0.60	0.30	0.00	0.90	0.60	0.00	
Apishapa	0.20	0.20	0.85	0.74	0.13	0.11	0.26	1.72	0.04	0.00	0.10	[1.10]	[5.45]
Aroya	0.08	[0.05]	[0.00]	2.25	1.44	0.43	1.53	1.66	0.87	0.12	0.20	T.	[8.74]
Beaver Creek			0.46	2.90			T.	1.36	0.00		0.44		
Bennett	0.70	0.62	0.05	4.00	1.75	[0.50]	0.85	2.02	0.20	0.70	0.70	[0.04]	[12.13]
Boulder Cañon		0.48		3.20		0.20	3.83	4.25		0.60			
Box Elder	[0.50]	[0.75]	0.35	2.08	0.73	0.89	2.51	2.25	0.00	0.80	0.70	0.15	[11.71]
Brandon			T.	2.03	0.33	0.66	1.34	0.85	0.00		0.00		
Breckenridge	1.05	1.40	6.45	2.15	[1.75]	0.25	1.76	1.76	2.12	2.90	1.50	0.85	[23.94]
Brush	0.30	0.57	T.	2.38	0.37	0.03	1.33	0.99	0.01	0.92	0.40	0.05	7.35
Byers	0.35	0.15	0.02				1.10	0.95	0.25	T.	0.73		
Cañon City	0.46	0.20	0.45	4.16	0.80	0.73	1.20	0.94	T.	[0.23]	0.70	0.03	[9.90]
Castle Rock			0.70	1.41	1.51	0.10	2.26	2.69	0.05	0.40	0.30	0.00	
Cheyenne Wells	0.10	0.25		1.95			2.25						
Chromo					0.23	0.26	3.00	1.44	2.21	2.21	0.30		
Climax	1.03	2.51	6.10	3.50	2.35	0.68	3.57	2.45	2.32	1.93	0.40	0.85	27.69
Colorado Springs	0.41	0.13	0.39	3.90	1.43	0.44	1.64	4.99	0.17	0.40	0.28	[0.00]	[14.18]
Como (ranch near)	0.34	[1.00]	1.02	2.47	1.28	0.27	4.85	2.83	1.25	0.91	[1.00]	0.02	[17.24]
Crook			0.01	2.66	0.77	1.93	0.93	k0.85	0.00	0.80	0.55		
Cumbres					T.	0.39	4.78	2.17	2.30	3.26		5.40	

Deer Trail	0.30	0.30	T.	1.20	T.	0.74	2.50	[1.00]	0.00	T.	0.05	[0.04]	[6.13]
Delta	0.80	0.85	0.83	0.98	0.45	c0.07	c0.79	1.59	0.48	1.42	0.15	0.76	9.17
Denver[3]	0.18	0.46	0.35	2.50	2.01	T.	0.79	1.89	0.17	0.64	0.30	0.04	9.33
Denver[4]	0.13	0.17	0.29	2.99	1.30								
Dillon	3.10	4.10	7.00	2.20	[2.04]	[0.50]	0.91	2.64	1.65	1.43	0.26	1.38	[27.72]
Durango[5]	1.90	0.46	1.80	2.30	0.00	0.40	0.30						
Durango[6]	2.08	2.62	1.68	2.75									
Eagle Farm	0.20	0.23	0.55	4.40	1.73	0.90	1.18	3.37	0.58	0.10	0.62	T.	13.86
Elkhorn			0.91			0.03	1.60	2.23	0.37	1.07	0.75	0.15	
Emma	0.93	1.45	0.91	0.27?							2.48	0.26	
First View	0.05	0.15	T.	1.73	0.97	1.60	3.23	1.92	0.98	0.50	0.10	0.10	11.33
Fort Collins[7]	0.13	0.21	0.22	3.92	1.19	0.12	1.27	3.14	0.07	0.70	0.32	0.12	11.41
Fort Collins (near)[8]				4.48		T.	1.28	2.13	0.02	0.87	0.44		
Fort Crawford	0.56	0.55	1.17	1.22	0.17	0.02	0.30	1.58	g0.43	[1.40]	[0.36]	[0.40]	[8.26]
Fort Lewis	5.20	2.30	1.75	3.13	0.10	0.45	0.96	2.35	1.03	1.49	1.39	4.12	24.27
Fort Logan	0.13	0.08	0.10	2.45	1.95	0.05	0.78	1.33	0.02	0.65	0.30	0.00	7.84
Fort Morgan	[0.20]	0.03	T.	2.35	0.89	0.37	2.94	1.24	0.00	1.00	[0.40]	[0.05]	[9.47]
Fraser	1.40	2.55	3.68	3.50									
Fruita	0.87	0.93	0.62	0.30	0.09	T.	0.87	0.74	0.87	0.49	0.22	0.73	1.73
Georgetown	0.35	0.82	0.86	1.84	1.12	0.32	1.75	2.50	0.79	0.92	0.37	0.08	16.72
Greeley	0.10	0.25	0.36	2.92	1.21	0.14		1.67					
Greenhorn						0.42	0.76	2.22	0.38	0.52	1.02	0.04	
Gunnison			0.26	1.70	0.00				0.24				
Hardin	0.18	0.05	0.05	2.43	0.96	0.18	1.12	3.80	0.00				
Hugo							2.50	2.70	0.02	0.25			
Husted	0.09	0.13	0.57	2.61	1.06	0.61	2.22	4.49	0.19	0.73	0.25	T.	12.95
Idaho Srings	0.30	0.54			1.53	0.38						0.22	
Julesburg				3.07	2.54	1.72	0.68	0.50	0.49		0.00		
Kirk	[0.35]	0.40	0.35	5.59	2.12	1.37	1.07	2.04	0.00	0.05	0.23	0.00	[13.57]
Kit Carson	0.05	0.05	[T.]	0.50	0.40	0.92	1.50	1.50	0.00	T.	0.00	0.04	[4.96]
Laird			0.11	3.36	1.41	1.20	1.00	0.25	0.00				
Lamar	0.20	0.16	0.05	2.14	1.02	1.57	1.62	1.63	0.33	0.37	0.05	0.00	9.14
La Porte					1.06		1.39	2.21	0.00	0.70	0.35		
Las Animas	0.20	0.40	[0.05]	2.30	1.12	0.05	0.22	0.90	0.00	0.03	0.00		
La Veta	0.00					1.13	2.93	2.54	1.25				
Lay			1.38	0.85	0.25	0.01	0.40			0.30	0.45	0.36	
Leadville	0.42	0.68	1.24	0.24	[2.00]	[0.36]	[1.30]	0.68	1.20	0.77	0.11	0.38	[9.38]

[1] Pacific Railroad System.
[2] A. W. Sehorn.
[3] Signal Service.
[4] Rev. Wm. Forstall.
[5] W. J. Iredale.
[6] T. J. Jackson.
[7] Prof. L. G. Carpenter.
[8] Miss Grace Birdsall.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Colorado—Continued.													
Le Roy			0.07	2.18	1.03	1.96	0.47	1.41	T.	0.98	0.48	0.01	
Livermore				2.90	0.62	0.02	1.15	2.34			0.26	0.15	
Longmont	[g]0.35			5.72		0.19	0.42	[b]2.75	0.16	0.74	0.32	[i]0.15	
Magnolia	0.50	0.72			3.00			1.38	0.55	0.20			
Middle Box Elder			0.42	4.56	1.33	0.04	1.49						
Minneapolis				6.31	1.03		3.19	0.97	0.09	0.37	0.35	0.15	
Monte Vista	0.00	0.12	0.56	2.13	0.18	T.	1.27	0.92	1.30	0.00	0.00	0.11	6.59
Montrose	0.80	0.78	0.56	1.36	0.16	0.03	0.71	1.38	0.68	1.41	0.58	0.65	9.10
Moraine	0.81	0.76	0.71	2.77	[1.30]	1.05	2.42	3.40	0.82	1.34	0.65	0.35	[16.38]
Morrison						[e]0.16	[e]1.06	1.53	0.31				
Pagosa Springs								1.10	1.39	2.02	0.35	1.90	
Palmer Lake	0.20	1.19	0.90	3.69	1.01								
Paoli													
Parachute	0.84	1.29	0.93	0.25	0.25	T.	0.76	1.04	0.43	1.24	0.96	0.39	8.38
Peyton	T.	0.35	0.30	2.66	1.15	0.77	0.70	2.89	0.36	[0.50]	T.	[0.00]	[9.68]
Pinkhamton					0.30			2.01	0.15	0.43			
Platoro		7.70	4.60	2.25			5.88						
Pueblo	0.12	0.25	0.48	2.08	1.71	0.58	0.56	1.99	0.02	0.20	0.32	T.	8.31
Red Cliff	[1.00]	[3.00]	3.11	1.17	1.40	0.76	1.46	2.30	1.71	1.84	0.27	0.46	[18.48]
Rifle Falls		2.66			0.34		0.08	1.72	0.79			0.50	
Rocky Ford	0.34	0.15	0.15	2.07	0.29	0.77	1.16	0.74	0.08	0.00	0.30	0.00	6.05
Saint Cloud									0.10	1.80	0.35	0.10	
Sanborn				3.00	2.26		2.66	3.25		0.27	0.68	0.00	
Sanborn			0.56	3.05	2.26	0.51							
San Luis Exp. Station	0.10	0.65	0.02	3.49	0.02	0.21	1.27	0.91	1.33	0.21	0.55	T.	8.76
Sedgwick	0.05	0.14	0.05	2.57	0.68	0.87	0.90	0.63	0.00	0.82	0.13	0.05	6.89
Sheridan Lake	[0.10]	[0.15]	T.	3.49	1.12	0.52	2.44	1.80	0.93	0.61	0.09	0.04	[11.29]
Smoky Hill									0.70	0.40	0.70	T.	
Springfield				4.72		1.22	1.68	1.49	0.43				
Stamford	0.45	2.00	2.00	3.75	0.70	0.37	0.72	0.23	1.85	[0.30]	2.12	1.85	[16.34]
Sterling						1.08	0.56	[d]0.85	0.00	1.06			
Sunnyside			0.15	1.50	[c]0.07	0.08							

Thon	0.07	0.14	0.18	1.28	1.80	0.54	1.44	2.23	0.27	0.15	0.03	T.	8.13
T. S. Ranche	0.55	0.90	1.27	0.38	0.28	0.07	0.82	3.12	d2.06	1.64	0.30	•T.	11.39
Upper Pine	[0.75]	[1.00]	2.74	2.72	1.82	0.30	2.00	1.64	0.00	1.10	[0.75]	T.	[14.82]
Vilas	0.33	0.11	0.14	3.82	0.86	0.82	1.17	0.69	[0.43]	0.00	0.00	0.70	[9.07]
Villa Grove	1.30	0.60	[0.50]	?0.08	0.10	[0.50]	3.00	0.12	0.08	0.67	0.20	0.51	[7.66]
Watervale	[0.00]	[0.00]	0.88	4.25	0.73	0.86	4.15	5.41	0.40	0.30	T.	0.40	[17.38
Watkins	0.35	0.80	0.02		0.75			3.12	0.00	0.12	0.22		
Westcliffe	0.12	0.50	0.39	2.32	0.27	0.30	2.92	T.	1.05	0.07	0.65	0.05	8.61
Wray	[0.30]	[0.20]	T.	4.44	1.42	0.62	0.25	1.09	0.45	0.25	0.25	T.	[9.27]
Yuma	[0.30]	[0.20]	0.10	5.30	0.67	0.87	0.63	1.58	0.01	0.73	0.50	0.10	[10.99]
Connecticut:													
Birmingham	2.48	[4.00]	6.55	2.76	[4.00]	[6.00]	4.23	4.47	5.11	7.17	0.82	3.80	[51.39]
Canton	2.47	4.39	5.80	2.35	5.01	3.42	4.66	5.35	5.54	7.88	0.70	4.20	[51.78]
Falls Valley	2.53	3.40	5.86	2.06	4.73	3.24	6.43	6.06	6.00	5.40	1.00	4.45	51.16
Fort Trumbull	2.63	2.25	6.55	4.61	5.17	2.46	4.92	2.53	4.67	7.40	0.82	3.69	[47.70]
Hartford[1]	3.02	3.91	7.03	3.10	6.53	2.89	5.25	4.15	3.78	7.05	0.71	3.30	50.72
Hartford[2]	2.40	3.64	7.26	3.00	6.02	2.86	5.25	4.05	3.83	7.57	0.65	3.48	50.01
Lake Konomoc	[3.30]	[2.40]	9.53	4.92	4.97	2.96	4.01	[5.50]	6.20	6.72	0.55	7.61	[58.67]
Lebanon	2.99	3.24	6.49	4.08	4.71	3.33	2.05	3.88	5.66	7.11	0.94	4.62	49.10
Mansfield	2.66	3.28	6.12	3.15	6.33	2.79	2.81	4.26	7.19	5.25	0.82	4.21	48.87
Middletown	2.84	3.28	7.45	2.84	5.51	2.16	4.16	4.66	5.97	7.52	0.75	4.46	51.60
New Hartford[3]	2.48	3.85	5.97	2.36	4.81	2.64	3.37	6.30	7.00	6.41	0.88	3.64	49.71
New Hartford[4]		4.05	4.60	2.03				7.04	8.59	7.45		1.75	
New Haven	3.07	3.19	6.60	2.89	4.24	3.12	6.59	2.67	5.38	7.63	0.67	2.90	48.95
Newington					6.14		4.44	2.25	3.93				
New London	3.31	2.40	8.60	4.86	4.51	2.94	3.07	2.43	5.51	6.43	0.86	3.93	48.85
North Woodstock				3.07	6.30	3.37	3.10	4.95	6.10	6.34	1.10		
Shelton	1.26	4.03	7.22	2.62	5.14	2.80	4.95	[8.00]	6.24	8.69	[0.60]	[2.90]	[54.45]
Southington	2.15	3.88	7.18	3.33	5.77	3.20	2.91	3.37	3.61	6.94	0.70	4.14	47.18
South Manchester	2.55	3.27	6.14	2.98	6.47	2.74	3.89	4.16	4.99	6.53	0.78	3.38	47.88
Uncasville	3.67	3.18	8.58	4.99	5.66	3.05	4.94	4.67	6.53	7.80	0.90	5.76	59.73
Voluntown	3.14	2.59	7.81	5.38	4.65	3.26	2.79	4.67	4.91	8.65	1.04	5.03	53.92
Wallingford	3.25	3.09	6.43	2.67	4.22	3.34	4.83	3.84	5.66	7.21	0.97	4.18	49.69
Waterbury	2.54	3.77	6.08	2.43	5.97	3.26	4.96	4.50	4.98	6.89	0.93	5.21	51.52
West Simsbury	2.38	3.70	5.30	2.35	4.89	2.92	4.77	5.23	5.72	6.49	0.61	4.03	48.39
District of Columbia:													
Washington Barracks	0.42	3.70	3.64	2.70	4.60	1.60	3.20	4.45	3.50	3.80	0.76	2.70	35.07
Washington City	1.54	4.20	3.65	2.81	4.73	2.02	3.24	5.50	4.22	5.15	0.79	3.74	41.59

[1] W R. Watson. [2] Rev. S. Hart, D. D. [3] Rev. Wm. Goodwin. [4] R. R. Smith.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Florida:													
Altamonte Springs	0.36	0.55	1.45	0.77	5.59	6.20	3.42						
Alva	0.24	0.69	1.17	0.39	8.17	7.23	6.47	8.51	10.19	3.21	2.15	0.54	48.96
Archer	0.18	1.28	3.25	1.33	10.53	2.33	11.28	2.72	6.22	6.47	0.94	1.29	47.82
Fort Barrancas	0.69	2.40	4.11	1.30	4.89	4.86	17.72	6.30	5.54	10.46	0.66	2.22	61.15
Fort Meade	[0.50]	1.35	4.90	0.25	9.60	3.94	6.81	7.39	14.83	5.00	3.38	1.75	[59.70]
Homeland	0.00	0.65	1.20	0.35	4.85	4.95	6.75	4.60	21.15	3.00	3.90	1.70	53.10
Hypoluxo	[2.00]	6.37	1.49	1.66	16.19	3.66	4.70	9.96	14.93	2.75	6.12	1.34	[71.17]
Jacksonville	0.63	0.51	2.89	0.95	9.20	1.80	9.70	4.26	4.88	9.07	2.26	1.37	47.52
Jupiter	2.41	2.00	2.44	1.13	13.51	2.51	6.92	8.70	8.69	5.43	4.95	2.66	61.35
Key West	1.06	2.38	2.17	1.11	3.84	3.33	3.70	2.25	16.14	1.86	4.67	0.36	42.87
Lake City	0.08	0.68	3.54	1.15	9.94	6.95	7.86	4.49					
Madison	0.59	3.00	3.39	0.12	12.72	7.23	10.72	3.16	12.34	4.51	1.06	[2.30]	[61.14]
Manatee	0.73	3.05	2.17	0.57	4.29	7.72	19.21	7.12	9.85	4.26	2.30	[1.15]	[62.42]
Matanzas	0.88	0.45	1.64	2.11	7.37	4.17							
Merritts Island	0.56	1.15	1.03	0.78	11.58	5.45	9.34	2.21	6.41	3.85	4.00	3.15	49.51
Micco	[d]T.	[a]0.12	[l]0.02	[g]T.	[c]10.19	[n]1.09	[j]3.05	[n]1.77	[l]2.67	[g]2.00	[d]5.70	[k]0.93	27.54
Ocala	0.11	1.53	1.21	[n]0.28								0.95	
Pensacola	0.65	2.03	2.89	1.34	3.14	2.21	13.68	3.89	6.98	7.76	0.69	1.76	47.02
Pine Level	T.	1.54	3.41	0.70	8.09	6.54	8.92	8.51	8.48	1.83	[3.00]	[1.15]	[52.17]
St. Francis Barracks	0.32	1.00	3.11	0.80	10.71	6.55	12.14	4.32	6.80	4.02	1.90	0.60	52.27
San Antonio	1.10	[1.00]	1.33	1.07	3.38	3.20	6.75	4.73	4.59	5.36	1.60	1.72	[35.83]
Tallahassee	0.78	3.75	4.66	0.85	12.36	5.15	9.20	4.00	5.82	5.45	0.65	2.90	55.57
Tampa	[0.50]	[2.50]	0.96	0.55	4.49	11.58	11.91	8.87	9.24	5.05	3.31	1.32	[60.28]
Titusville	0.34	0.83	3.84	0.76	15.14	6.26	7.49	3.74	8.54	2.21	3.26	0.92	53.33
Villa City	0.26	0.59	1.62	0.60	7.68	0.04	5.93	4.91	6.44	2.11	2.82	0.83	33.83
Georgia:													
Albany					2.93	4.25	5.28	4.93	4.76	4.44	0.05		
Allapaha	0.97	2.89	[4.00]	[0.75]	6.99	8.97	6.01	2.76	7.98	3.83	1.70		
Andersonville	2.90	0.95	7.68	3.37	6.38	5.01	5.32						
Athens[1]	2.56	2.89	4.32	1.42	9.27	5.44	8.67	5.14	6.97	6.11	0.76	2.60	56.15
Athens[2]	2.52	1.82	3.61	2.46	10.48	7.36	8.29	7.19	6.99	6.31	0.31	3.56	60.80
Atlanta	2.95	3.36	3.13	2.04	6.32	1.12	5.37	3.99	5.36	4.89	0.18	3.89	42.60

Augusta	0.80	1.88	3.05	2.33	5.28	3.70	9.16	2.26	8.91	3.96	0.47	1.18	42.98
Bainbridge					1.80	4.55	11.90	1.98	[c]6.51	5.64	0.21		
Blakely							12.49	4.20	9.28	4.66	0.24	1.91	
Camak					5.44	4.62	12.67	2.62	7.62	5.40	0.12		
Cartersville					3.27	2.50	3.17	6.55	4.22	6.96	0.15		
Columbus					8.23	1.93	7.08	2.44	3.76	3.84	0.16		
Diamond	4.55	10.75	5.85	8.75	11.60	6.59	7.59	7.99	19.55	7.62	0.50	2.03	93.37
Eastman					10.54	3.91	9.79	2.35	9.91	4.55	0.70		
Forsyth	2.87	4.39	2.66	1.80	7.31	2.40	5.35	2.74	5.56	5.89	0.50	2.88	44.35
Fort Gaines					6.61	2.26	8.06	3.37	4.59	4.19	0.26		
Fort McPherson	3.41	3.68	2.87	2.11	5.87	2.31	7.32	3.63	6.25	4.60	0.18	3.59	45.82
Gainesville					0.65	0.21	5.15	6.44	8.91	6.70	0.00		
Gillsville	2.55	6.32	4.15	1.65	4.40	2.40	8.25	4.62	15.84	[6.00]	0.03	4.05	[60.26]
Griffin					7.25	2.17	5.47	5.93	3.67	4.33	0.00		
Hephzibah	0.09	0.14	1.18	0.13	3.15	1.19	5.38	3.50	3.19	[4.00]	1.08	0.16	[23.19]
Jesup	T.	1.23	2.16	0.77	4.19	4.90							
Louisville		1.98	2.91	1.93	8.40	1.90	8.24	1.46	6.87	5.16			
Macon					8.20	1.10	6.00	2.78	6.25	4.94			
Marietta	3.25	5.20	4.45	3.42	6.44	5.02	6.40	4.90	4.44	5.60	0.21	3.23	52.56
Milledgeville	1.75	1.74	2.48	3.08	4.48	2.02	6.62	4.42	12.95	5.59	T.	2.25	47.38
Millen	0.97	[1.75]	3.55	1.57	5.97	5.07	6.32	2.14	7.73	4.00	0.81	[2.00]	[41.88]
Monticello	1.97	3.52	3.90	1.23	6.95	4.50	9.62	1.92	8.55	6.49	0.20	2.66	51.51
Newnan					6.07	3.52	6.09	1.92	8.37	5.84	0.14		
Perry	[2.90]	2.19	2.31	1.24	5.56	2.70	7.59	1.42	6.24	4.94	0.85	2.25	[40.19]
Point Peter	2.45	2.55	3.75	1.75	5.65	1.30	7.05	4.95	6.85	6.15	[0.93]	2.25	[45.63]
Paulan									13.16	3.46	0.44	1.05	
Quitman [3]	0.42	3.80	1.85	0.50	8.80	3.80	12.60	5.10	6.40	3.30	1.40	2.15	50.12
Quitman [2]					8.68	2.62	6.52	2.35	8.17	2.20	2.27		
Savannah	0.44	1.02	2.75	1.09	3.13	4.38	7.72	2.80	16.58	4.12	0.51	2.92	47.46
Thomasville [4]	0.60	2.94	5.54	0.07	6.46	[4.00]	9.88	2.76	5.75	6.23	[0.75]		
Thomasville [2]					5.66	4.52	11.03		4.90	5.19	1.16		
Toccoa					6.43	1.75	6.95	3.77	9.62	5.97			
Union Point					5.19	1.75	5.52	0.16	9.09	4.50	0.00		
Washington					6.86	3.21	5.64	2.87	10.67	4.96	1.55		
Way Cross					6.12	2.10	3.43	1.50	3.38	2.17	0.30		
Waynesboro					7.99	3.91	5.67	1.78	6.95	4.55	0.12		
West Point					5.16	4.35	3.86	3.88	4.09	6.27	0.00		

[1] Prof. L. H. Charbonnier. [2] Cotton belt. [3] J. L. Cutler. [4] R. Thomas, jr.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Idaho:													
American Falls				2.13	0.45	0.52	0.69	0.55		0.93	0.00	1.07	
Beaver					0.37	0.67	1.49	2.80	T.	0.60			
Boisé Barracks	1.70	1.83	3.56	0.00	1.94	0.56	0.00	0.24	0.16	0.77	0.00	0.96	11.72
Boisé City	1.26	3.12	3.34	0.48	1.64	0.56							
Bonanza				°0.12	1.06	1.31	0.45	0.92	0.86		0.40	0.90	
Era	6.56	4.87	1.14	0.52	0.95	0.28	0.22	0.04	0.57	0.70	0.00	0.82	16.67
Fort Sherman	4.81	5.80	2.63	0.69	0.88	4.10	0.14	1.05	[0.94]	1.40	0.53	1.91	[24.88]
Henrys Lake					1.21	7.90	1.40	1.68	0.40	0.99	0.02	0.78	
Kootenai	2.79	2.94	1.15	0.83	0.67	3.07	1.21	1.69	2.99	3.07	0.56	1.69	22.66
Lewiston	0.42	1.14	1.90	0.45	1.20	2.36	0.06	0.18	0.04	0.73	0.05	1.20	9.73
Mullan	3.00	2.00	1.90	0.50	1.52	3.82	[0.10]	0.80	0.53	2.61	[1.96]	3.38	[22.12]
Payette				0.93	1.18	0.48	0.02	0.14	0.04	0.11	0.00	1.94	
Soda Springs	3.05	3.50	1.06	1.80	0.88	1.08	0.29	0.63					
Illinois:													
Atwood	14.62	3.71					4.34	2.91		2.56			
Aurora[1]	[3.24]	1.18	2.64	2.17	4.25	6.97	0.78	2.38	1.90	4.53	1.79	0.78	32.61
Aurora[2]	3.24	1.68	3.13	2.83	5.84	6.64	1.04	2.77	2.31	5.14	2.08	1.00	37.70
Beardstown	2.75	0.90	1.45	2.60	2.80	3.84	3.57	2.00	1.10	1.38	1.63	0.00	24.02
Beason	4.35	1.36	1.99	2.71	2.56	3.70	2.50	2.90	0.80	2.90	1.10	0.20	24.07
Belvidere	2.91	1.89	1.88	2.94	5.08	8.46	0.33	3.22	0.76	5.81	1.91	1.25	36.44
Cairo	6.32	7.57	6.14	3.76	4.19	1.45	1.62	5.16	2.27	3.04	6.08	2.91	50.51
Centralia	10.38	5.26	7.45	6.65	[4.00]	[2.70]	2.29	2.92	6.32	1.44	2.43	1.40	[53.24]
Charleston	[6.00]	3.41	3.37	2.66	3.40	6.75	6.98	1.87	2.22	2.19	1.93	1.13	[41.91]
Chicago	2.98	2.42	2.10	3.23	5.13	3.25	2.57	2.58	1.39	4.20	1.59	1.25	32.69
Cockrell	[2.90]	[2.15]	[2.00]	2.34	3.89	13.57	0.50	4.93	1.30	5.23	1.96	0.63	[41.40]
Collinsville	6.00	3.88	4.69	4.01	3.13	3.56	0.88	0.95	2.31	0.85	1.92	1.31	33.49
Dwight	4.59	1.45	3.37	3.95	5.08	7.38	0.90	2.05	1.30	[4.00]	[1.75]	[0.25]	[36.07]
East Peoria	3.12	1.57	3.13	2.19	2.99	2.45	1.53	2.29	2.03	2.42	2.14	0.47	26.33
Flora	10.06	4.74	7.41	5.27		3.41	1.99						
Fort Sheridan	2.68	1.84	2.33	4.82	5.25	7.77	1.25	2.47	1.32	6.02	0.92	2.27	38.94
Golconda	7.35	7.47	9.21	4.79	4.70	2.17	0.83	2.58	4.91	2.90	7.35	1.37	55.63
Grand Tower	9.01	7.61	5.42	5.11	2.35	1.80	2.58	2.64	5.72	1.90	4.23	0.22	48.59

Greenville	9.61	4.50	4.21	4.62	2.58	2.49	1.17	2.60	2.89	1.00	2.06	1.64	39.37
Griggsville	3.31	1.43	2.75	2.85	3.31	5.32	1.47	1.85	2.47	1.48	1.40	0.28	27.92
Hennepin	2.05	2.03	2.55	3.39	4.54	3.98	0.66	1.45	3.07	5.57	1.45	0.20	30.94
Irishtown	8.41	3.86	4.56	5.40	3.65	3.08	0.58	1.22	3.44	0.60	2.39	0.77	37.96
Jordans Grove	8.12	3.93	7.33	6.54	2.92	1.38	1.73	7.06	4.34	0.62	2.38	1.59	47.94
Lacon	2.77	1.86	4.18	1.69	3.95	3.84	0.55	1.85	1.96	3.95	2.17	0.87	29.64
Lake Forest	2.76	1.77	3.29	4.29	5.08	5.29	----	----	----	----	----	----	----
Lanark	2.76	1.61	2.13	[2.80]	3.71	12.32	0.78	2.96	1.36	5.43	1.87	0.81	[38.54]
Louisville	8.30	4.15	6.45	4.80	2.70	3.72	3.14	3.05	4.90	1.38	2.20	2.50	47.29
Martinsville	6.19	5.98	3.34	3.46	3.57	3.68	3.00	4.24	4.60	1.45	2.25	1.34	43.10
Mascoutah	10.00	4.70	4.62	8.20	2.80	3.20	0.30	1.90	5.30	[1.25]	2.60	1.30	[46.17]
Mattoon	----	----	----	----	----	2.50	2.70	----	----	2.05	0.25	1.00	----
McLeansborough	7.12	5.23	5.94	4.03	4.10	2.10	5.53	7.05	4.69	1.13	[5.00]	1.38	[53.30]
Mount Carmel	8.77	7.41	8.27	3.65	3.19	3.02	4.77	6.14	4.66	2.35	5.26	1.73	59.22
Olney[3]	[7.21]	[4.48]	6.52	3.81	3.95	4.37	1.25	4.78	5.47	1.60	2.05	1.86	[47.35]
Olney[4]	7.21	4.48	7.51	4.68	6.02	5.94	1.39	4.44	5.84	1.38	2.46	2.16	53.51
Oswego	2.44	1.30	2.89	2.58	5.27	6.98	1.19	2.65	2.17	4.60	1.89	0.75	34.71
Ottawa	2.59	1.40	3.33	1.87	3.99	6.87	0.34	2.72	2.48	3.89	2.06	0.27	31.81
Palestine	9.20	4.96	5.65	4.07	4.31	2.58	2.35	3.56	5.38	2.97	2.74	1.90	49.67
Pana	11.65	2.01	6.32	3.41	3.57	5.25	3.33	3.66	4.66	1.16	3.50	1.12	49.64
Peoria[5]	2.89	1.33	2.88	1.19	2.51	2.56	1.44	2.31	2.07	3.17	1.95	0.09	24.39
Peoria[6]	2.80	1.36	2.73	2.33	2.74	2.42	0.72	2.39	2.12	3.45	1.79	0.41	25.26
Philo	6.35	3.47	2.35	3.95	3.84	5.14	2.02	1.81	1.50	2.22	2.36	0.13	35.14
Pontiac	4.18	1.20	3.58	4.15	3.65	5.10	0.75	1.95	0.35	2.61	1.45	0.30	29.27
Riley	2.65	1.52	2.14	2.88	4.33	9.64	0.53	3.83	0.67	5.38	1.74	1.13	36.44
Rockford	2.81	2.69	2.42	3.76	5.28	12.33	0.83	3.38	0.60	5.98	2.23	1.60	43.91
Rock Island Arsenal	3.06	1.91	3.20	0.99	5.03	5.28	1.24	2.09	3.40	4.38	1.71	1.20	33.49
Rushville	2.99	1.43	2.49	2.33	3.42	3.92	4.19	2.14	3.64	1.49	2.06	0.25	30.35
Sandwich	2.69	1.62	[2.75]	[2.40]	[5.00]	7.54	0.61	3.32	2.15	4.16	1.75	0.33	[34.32]
South Evanston	1.71	[1.25]	2.96	2.68	4.38	5.94	2.31	2.70	1.49	5.00	1.70	0.73	[32.85]
Springfield	5.72	2.01	2.20	2.94	4.33	4.50	2.14	1.03	0.96	1.30	1.29	0.26	28.68
Sycamore	1.64	1.15	1.57	2.58	3.87	7.98	0.42	2.07	1.22	3.48	1.87	1.50	29.35
Warsaw	1.80	1.00	0.17	[1.50]	2.50	2.09	1.75	1.07	3.17	1.08	1.85	T.	[16.36]
Watseka	4.79	1.77	3.28	3.86	5.37	5.78	1.57	2.70	2.08	3.73	1.56	[0.25]	[36.74]
White Hall	6.70	2.55	2.12	2.09	3.02	3.81	2.09	1.63	2.04	1.05	0.94	0.43	28.47
Winnebago	3.39	2.73	1.64	3.50	4.35	10.15	0.40	2.55	0.50	6.40	2.10	1.40	30.11

[1] W. Holden.
[2] Dr. M. M. Robbins.
[3] Victor E. Phillips.
[4] State weather service, per C. H. Fahs.
[5] Signal Service river record.
[6] Dr. Frederick Brendel.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Indiana:													
Angola	3.91	3.24	3.16	4.20	5.30	2.26	0.62	3.32	6.52	3.85	2.88	0.89	40.15
Butlerville	7.29	5.39	7.03	3.73	4.45	5.01	2.20	4.66	3.79	3.39	4.26	1.42	52.62
Cannelton	7.16	7.56	10.99	2.66	5.07	2.91	[2.00]	4.73	4.50	1.95	5.75	3.86	[59.14]
Columbia City	6.19	2.48	3.47	4.46	5.17	4.80	1.35	2.50	5.07	4.16	2.38	1.16	43.19
Columbus	7.51	6.09	5.70	2.94	2.26	5.23	0.19	6.00	3.36	3.01	2.41	1.59	46.29
Connersville	5.97	5.93	4.74	2.71	3.90	4.80	0.30	2.85	4.27	2.98	2.86	1.03	42.34
Crandall					10.62		4.44	3.75	3.75		5.45		
De Gonia Springs	5.82	7.06	10.74	5.08	5.59	3.07	2.33	6.67	2.87	2.48	5.04	2.15	58.90
Delphi	5.59	2.63	3.12	6.46	7.44	3.97	1.53	3.19	2.18	2.19	2.20	0.46	40.96
Evansville	6.01	7.33	10.31	5.34	4.30	4.75	2.54	2.53	6.60	1.79	3.08	1.57	56.15
Farmland	6.57	3.91	3.96	3.57	5.89	4.60	0.90	5.96	9.02	2.32	[2.76]	1.90	[51.36]
Franklin	8.09	6.25	4.05	3.46	3.33	3.96	0.05	3.82	4.80	3.39	2.98	2.27	46.45
Huntingburg	11.90	12.12	10.87	6.27	5.80	10.89	[2.40]	5.87	2.21	2.10	5.72	[3.00]	[79.15]
Huntington	4.57	2.90	3.04	7.02	5.01	3.07	1.07	3.78	3.19	2.32	1.52	0.33	37.82
Indianapolis	10.20	5.28	4.46	4.58	3.61	4.45	0.97	5.00	7.31	4.02	3.35	1.64	54.87
Jeffersonville	6.04	7.07	9.94	3.56	3.66	6.04	3.16	4.31	2.47	3.49	4.89	3.69	58.32
Laconia	6.60	7.10	8.55	2.00	4.35	6.15	1.70						
La Fayette	4.59	2.52	3.11	3.72	5.11	6.27	2.58	7.17	2.30	2.70	2.22	0.23	42.52
Logansport[1]	5.69	2.53	4.85	7.17	8.32	8.38	3.17	3.51	3.23	2.82	2.05	0.46	52.18
Logansport[2]	5.69	2.66	3.56	5.71	6.17	5.47	2.43	2.67	3.24	2.55	1.44	0.50	42.09
Marengo	9.70	7.70	16.70	8.80	8.20	10.50	10.90	8.20	3.47	4.60	6.01	[2.00]	[96.78]
Marion	4.10	1.40	1.40	3.10	6.10	2.60	1.12	2.70					
Mauzy	8.05	5.52	4.86	3.11	3.24	4.90	0.45	3.48	3.98	3.57	2.67	1.61	45.44
Mount Vernon[3]	6.54	6.81	10.19	6.70	3.12	2.26	1.98	3.97	3.30	3.71	5.78	1.76	56.12
Mount Vernon[4]	6.54	6.81	10.19	6.70	3.12	2.26	1.98	[4.00]	3.48	3.71	5.78	1.76	[56.33]
Muncie	[7.00]	[4.30]	3.07	3.67	5.79	3.16	1.49	2.52	5.61	2.05	2.88	1.70	[43.24]
New Providence	5.00	6.19	11.17	5.27	4.06								
Point Isabel	5.83	4.02	5.64	6.73	8.34	5.32	1.42	4.45	7.30	3.40	2.73	1.05	56.23
Princeton	7.65	7.15	8.75	4.35	3.70	3.75	4.10	3.98	3.65	2.01	5.52	2.35	56.96
Richmond	7.09	5.81	4.35	2.81	3.30	3.81	0.24	4.00	4.25	2.72	[2.50]	[1.00]	[41.86]
Rockville	[2.80]	[3.00]	3.31	3.15	3.89	4.13	4.15	4.06	2.22	2.92	1.79	0.87	[36.29]
Rushville	8.75	6.07	4.55	3.29	3.10	5.09	0.88	5.16	3.12	3.38	3.32	1.33	48.04

Seymour	*6.96*	*6.15*	*6.40*	*3.73*	*3.21*	*4.41*	*2.19*	*4.86*	*2.07*	*4.42*	*3.59*	*1.89*	*49.88*
Shelbyville	7.30	4.14	4.24	3.10	3.46	3.91	[1.12]	[4.30]	[3.40]	3.44	1.10	0.70	[40.21]
Spiceland	9.03	5.30	4.26	3.40	2.65								
Sunman	6.11	5.66	5.20	2.72	3.19	5 87	1.15	4.43	2.44	4.15	[2.65]	[1.90]	[45.47]
Valparaiso					4.89	2.71			1.59	3.63	1.37	1.37	
Vevay	7.37	6.06	7.84	4.33	4.73	9.50	5.61	3.46	2.81	3.07	2.92	3.03	60.73
Vincennes	9.44	7.19	6.89	4.11	3.47	2.55	1.47	6.34	3.84	2.14	4.15	2.06	53.65
Worthington	10.69	5.60	5.36	4.30	4.53	3.84	0.62	4.78	5.57	2.21	3.53	1.71	52.74
Indian Territory:													
Eufaula	1.10	2.55	3.75	7.60	5.55	1.60	1.80	9.25	5.77	3.04	5.21	1.80	49.02
Fort Gibson	3.95	2.84	4.42	7.39	5.61	0.36	0.00	7.52	6.88	[3.00]	[5.40]	[3.80]	[51.17]
Fort Supply[5]	1.80	0.18	0.00	2.98	2.21	2.37	1.74	3.33	1.29	0.74	1.53	0.09	18.26
Fort Supply	1.89	0.15	T.	3.48	2.29	2.86							
Healdton	1.22	0.84	3.26	10.39	2.44	2.11	0.75	3.58	4.79	4.29	3.78	2.96	39.51
Tulsa	2.35	1.25	0.80	4.70	3.70	0.85	1.15	9.30	3.35	3.85	1.75	1.10	34.15
Iowa:													
Afton							4.40	5.00	2.30	4.90			
Alta	1.67	1.06	2.82	1.95	3.20	7.40	2.95	4.16	3.44	2.56	1.14	0.25	32.60
Amana	2.49	0.97	1.39	1.50	2.60	6.36	0.60	3.83	1.22	4.69	1.89	0.37	27.91
Ames	1.95	0.95	1.20	2.10	4.62	5.65	1.85	4.55	3.20	2.38	[0.70]	[0.10]	[29.25]
Atlantic	[2.00]	[1.00]	[1.00]	0.43	2.26	5.30	2.34	3.22	1.94	2.36	1.17	0.13	[23.15]
Bancroft	2.05	0.35	1.95	1.94	3.88	5.93	0.60	1.49	4.67	2.40	1.10	1.00	27.36
Belle Plaine	2.05	1.00	1.15	1.42	4.34	6.63	0.42	3.78	2.32	3.86	1.93	0.42	29.32
Blakeville	3.46	1.05	1.49	1.23	5.05	8.45	2.65	3.43	3.36	5.45	1.59	[0.50]	[37.71]
Carroll	1.71	0.65	1.98	1.78	3.26	9.64	3.80	2.18	1.36	2.70	1.22	0.16	30.44
Carson	1.30	0.25	1.70	1.05	2.40	6.52	1.40	1.80	3.23	1.94	1.12	0.16	22.90
Cedar Rapids	2.10	1.04	2.08	2.42	3.06	9.54	1.97	4.27	2.90	4.62	1.87	0.40	36.27
Clarinda	2.15	0.40	1.95	0.65	4.42	6.40	1.15	4.94	2.62	1.65	1.39	0.00	27.72
Clinton	2.35	1.73	2.97	2.72	4.43	6.50	0.40	3.12	1.97	3.76	1.45	0.82	32.22
Cresco	1.90	0.81	1.06	1.64	4.73	11.71	1.32	2.79	3.21	3.98	1.59	0.44	35.18
Davenport	2.49	1.10	2.34	0.86	4.33	4.51	0.85	1.66	2.34	3.63	1.37	0.62	26.10
Des Moines	2.62	1.17	0.91	0.78	3.00	4.91	1.10	3.35	1.57	4.48	0.74	0.11	24.74
Dubuque	2.31	1.25	1.68	2.94	5.36	9.59	1.21	6.00	3.72	6.43	1.85	0.82	43.16
Eagle Grove	0.35	0.85	1.10	5.15	4.80	11.95	5.00	4.85	4.85	4.50	1.00	0.65	45.05
Elkader	2.05	0.50	0.86	3.33									
Fayette	1.69	0.88	1.21	3.53	5.75	16.53	2.90	3.45	3.62	4.56	1.49	[0.48]	[46.09]
Fort Madison	2.49	1.83	3.67	1.39	3.14	6.38	2.30	2.37	2.07	4.13	1.84	2.50	34.11
Glenwood[6]		0.25	0.32	0.38	3.28	3.79	3.13	4.08	2.64	2.22	1.30	0.00	

[1] United States rainfall station. [2] D. E. Prior. [3] Signal Service river station. [4] J. M. Lockwood. [5] U. S. post hospital. [6] Seth Dean.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Iowa—Continued.													
Greenfield	-----	-----	-----	-----	-----	-----	-----	-----	2.12	2.95	1.54	0.06	-----
Grinnell	0.38	0.65	0.68	1.38	3.26	5.30	1.62	4.28	1.44	6.09	2.15	T.	27.23
Hampton	1.74	0.71	1.55	2.28	4.02	11.95	1.57	4.00	3.19	3.52	3.55	0.80	38.88
Humboldt	0.94	0.27	1.18	2.70	3.72	7.24	3.39	4.54	4.28	2.90	0.74	1.00	32.90
Independence	1.99	[d]1.08	1.10	2.98	4.63	8.00	1.65	2.97	4.48	4.19	1.50	0.54	35.11
Indianola	-----	-----	-----	-----	1.60	3.86	-----	-----	-----	2.13	1.30	0.36	-----
Iowa City	2.75	0.75	1.80	1.83	2.20	7.99	[1.30]	2.29	1.44	2.11	1.56	0.31	[26.33]
Irwin	-----	-----	-----	-----	3.19	10.48	3.04	2.55	-----	-----	-----	-----	-----
Keokuk	1.81	1.09	2.43	1.79	3.34	3.41	2.49	1.77	4.46	2.44	1.87	0.03	26.93
Larrabee	0.99	0.63	1.56	3.29	3.52	6.65	2.67	3.92	2.93	2.16	0.71	0.57	29.60
Le Claire	2.20	1.16	2.05	1.17	6.36	4.49	0.31	1.03	1.33	3.48	0.96	0.54	25.08
Logan	1.09	1.10	1.76	2.17	6.29	14.09	2.29	1.19	1.78	1.87	1.32	[0.10]	[35.05]
Manson	2.69	1.16	1.15	4.46	3.05	9.78	2.37	6.44	4.35	4.93	1.99	0.75	43.12
Maquoketa	3.19	1.33	1.90	1.70	3.03	10.90	1.17	5.42	2.44	4.45	2.28	0.52	38.33
McCausland	1.68	2.18	1.77	2.05	6.44	7.48	0.41	2.08	2.90	3.68	1.33	0.24	32.24
Monticello	1.90	0.98	1.86	2.09	4.48	12.19	1.79	4.97	4.05	6.82	2.21	0.71	44.05
Mount Pleasant	1.85	1.20	2.03	1.02	3.20	3.24	0.06	2.03	1.65	3.01	1.75	0.13	21.17
Mount Vernon	1.30	[1.00]	[2.00]	1.30	3.65	12.50	1.52	5.36	0.97	4.65	1.65	0.45	[36.35]
Muscatine[1]	1.90	1.70	3.29	1.12	3.61	6.68	1.88	2.35	2.52	4.24	1.38	1.20	31.87
Osage	1.61	0.37	1.52	1.48	4.39	8.15	0.85	2.16	3.66	5.15	1.56	0.34	31.24
Oskaloosa	1.41	0.85	0.89	0.60	1.85	1.57	0.37	2.78	2.61	1.59	1.27	0.75	16.54
Panama	-----	-----	-----	-----	-----	-----	-----	-----	0.61	1.90	1.30	0.07	-----
Sac City	1.60	0.65	1.13	0.25	3.65	7.00	1.75	1.70	1.10	3.75	0.50	0.45	23.53
Sioux City	1.14	0.40	2.12	1.32	2.29	3.61	2.59	3.64	2.36	1.84	0.84	0.10	22.25
Storm Lake	1.16	0.44	1.94	2.69	2.50	5.86	3.38	3.99	2.82	2.57	1.05	0.44	28.84
Vinton	2.24	0.50	1.38	2.05	4.26	9.20	1.13	3.07	2.65	4.47	1.74	0.89	33.58
Washington	2.23	1.27	1.84	0.28	2.22	5.44	0.75	2.65	2.05	2.45	1.52	0.18	22.88
Webster City	1.49	0.85	1.08	1.85	4.25	7.12	2.38	1.75	3.75	5.00	1.25	0.50	31.27
Wesley	1.15	0.45	1.65	1.80	2.65	8.10	1.15	1.25	-----	-----	-----	-----	-----
West Bend	1.53	1.35	1.77	2.47	3.26	7.49	1.21	2.77	3.58	4.05	1.40	1.40	32.28
Kansas:													
Abilene	2.01	0.32	[0.25]	1.50	0.65	1.90	0.30	5.30	1.00	2.24	1.20	1.22	-----

Allison	*0.54*	*0.40*	*0.05*	*3.34*	*1.50*	*4.71*	*0.54*	*2.16*	*0.62*	*0.46*	*1.35*	*0.05*	*15.72*
Alton					0.36	5.12	0.13	2.61	1.07	1.76	1.07	T.	
Altoona									1.13	3.55	3.45	1.08	
Arlington	2.02	0.50	0.04					2.85	1.00				
Bucklin	1.30	0.40	T.	2.90	2.15	1.20	0.60	3.20	0.80	1.10	0.40	0.50	14.55
Buffalo Park	0.35	[0.64]	[0.12]	1.87	[0.72]	2.50	1.60	1.75	0.25	0.50	0.55	0.00	[10.85]
Bunker Hill	2.30	0.40	0.00	0.95									
Burr Oak	0.75	0.15	0.00	0.25	1.00	3.57	0.25	58.7	1.00	2.25	0.75	0.00	15.84
Cawker City	1.01	0.20	[0.00]	1.20	1.05	4.80	0.80	1.30	1.00	0.90	0.80	T.	[13.06]
Coldwater				2.50	1.62	4.30	0.75	3.95	3.00	0.37	0.50		
Collyer	0.85	0.60	0.05	6.15	0.40	1.90	1.70	2.00	0.40	0.70	1.30	0.00	16.05
Columbus							0.00	11.00	3.00	5.60	2.07	1.55	
Concordia[2]	1.38	0.25	0.14	2.22	2.26	3.63	0.23	3.33	2.11	0.78	1.24	0.06	17.63
Concordia[3]	1.55	0.22	0.05	1.89	1.66	3.90	1.31	4.42	1.44	0.87	0.38	[0.06]	[17.75]
Conway	1.80	0.85	0.10	1.90	2.40	5.20	0.10	5.65	1.67	[2.30]	[0.09]	[1.20]	[23.26]
Cunningham	1.98	0.14	0.04	2.30	2.58	9.02	0.34	0.64	0.95	0.83	0.41	1.19	20.42
Dodge City	0.42	0.39	0.05	2.90	1.19	1.00	0.22	3.45	0.57	0.89	0.50	0.14	11.72
Downs	1.27	0.36	0.12	1.19	1.83	4.05	1.07	1.21	1.62	0.99	0.81	T.	14.52
Elco	[2.00]	[0.40]	0.45	3.27	3.84	2.65	1.86	5.52	2.58	4.15	1.35	1.00	[29.07]
Elk Falls	1.92	T.	0.70	2.64	2.05	2.50	1.71	3.22	1.40	3.54	3.00	0.44	23.12
Ellis[4]	0.70	0.60		4.77			0.25	0.38					
Ellis[5]		0.60				2.12		1.00		0.00	1.50	0.12	
Ellsworth	1.50	0.50	T.	1.50									
Emporia			0.00	3.84	4.22		1.89	8.17	4.92	4.39	2.30	1.27	
Englewood	0.96	0.27	0.02	2.33	2.96	3.27	3.93	3.23	1.03	2.29	0.28	1.11	21.68
Eureka Ranch	0.58	[0.46]	0.05	3.42	0.55	1.40	2.22	2.48	1.25	0.45	0.80	0.00	[13.66]
Fort Leavenworth	3.40	1.24	0.58	2.45	4.73	2.03	1.42	5.38	3.68	3.49	1.99	0.49	30.88
Fort Leavenworth	2.68	0.55	0.70	2.82	3.71	1.89	1.95	4.50	3.30	3.20	2.10	0.40	27.80
Fort Riley	2.12	0.21	0.04	2.75	1.24	2.46	1.02	7.46	0.88	2.74	1.05	0.12	22.09
Fremont	1.25	0.45	0.05	4.42	1.30	2.42	0.20	2.10	0.44	1.24	1.00	T.	14.87
Garden City	T.	T.	T.	3.48	2.02	2.48	0.62	1.75	0.72	0.48			
Gibson			T.	3.76	0.72	0.43	0.29	3.19	0.54				
Globe	2.60	0.69	0.51	2.57	6.11	2.22	2.90	4.16	5 70	5.02	2.71	1.00	36.19
Gove City	0.91	0.64	0.12	3.16	0.36	0.20	2.17	0.92	1.10	0.60	0.83	T.	11.01
Grainfield	0.45	0.45	0.10	4.00	2.50	1.20	1.65	1.00	0.50	0.50	1.10	0.00	13.45
Greenridge		0.38	T.	3.50	1.12								
Grenola	2.40	0.20	0.70	2.00	1.70	2.90	2.10	4.30	1.70	3.30	3.30	0.90	25.50
Grinnell	1.25	0.32	T.	3.26	1.00	1.00	3.73	1.80	1.20	0.45	0.25	0.60	14.26

[1] J. P. Walton. [2] Signal Service. [3] H. A. Williams. [4] F. L. Williams. [5] Agent U. P. R. R.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Kansas—Continued.													
Halstead	2.19	0.30	0.06	2.69	2.13	8.20	1.33	3.05	1.52	2.64	0.94	1.21	26.26
Havensville	2.25	0.20	0.30	3.75	1.83	3.08	1.08	6.00	2.58	0.50	1.50	0.70	23.77
Hays City	1.37	0.40	0.20	4.00									
Horton	2.84	0.87	0.67	1.47	2.87	4.69	1.81	4.63	6.62	2.24	1.49	0.15	30.35
Hoxie			T.	3.15		2.17				0.38	0.56	0.00	
Independence	3.17	0.95	0.85	2.41	3.33	2.59	4.13	3.06	1.37	3.65	3.82	1.44	30.77
Junction City	2.06	0.47	0.62	3.25	2.12	3.58	0.75	6.16	1.42	3.06	1.20	[0.12]	[24.81]
Kansas City	1.70	0.58	0.80	3.19	3.36	2.01	1.35	4.32	4.43	4.15	2.86	0.28	29.03
Kellogg	2.25	0.40	0.72	3.98	5.18	3.78	0.55	3.96	3.06	3.85	2.70	1.30	31.73
Kingman	1.72	0.38	0.20	2.07	2.27	6.50	1.00	2.66	1.32	1.50	[2.50]	1.25	[23.37]
Kirwin	0.13	0.16	0.05	2.27	0.90	4.58	0.25	3.00	0.25	1.05	1.25	0.00	13.89
La Crosse					0.64	1.55		4.83	1.78	0.44	0.81	T.	
La Harpe	1.28	1.03	0.95	1.83	4.91	2.76	1.86	8.83	5.22	3.19	2.87	1.20	35.93
Lakin		0.30	0.00	6.60	0.50	2.03	0.85	1.40	1.10	0.05	0.50	0.05	
Larned			T.	2.20	0.31		0.25	5.10	1.18	1.06			
Lawrence	2.50	0.75	1.02	2.51	5.14	2.12	1.56	6.19	5.62	5.35	2.56	1.00	36.32
Leavenworth	1.27	0.54	1.00	2.23	4.10	1.93	1.61	5.85	3.81	3.86	1.89	0.40	28.49
Lebo	1.98	0.52	0.51	3.70	6.84	1.62	3.20	8.72	4.98	6.08	3.47	0.92	42.54
Leoti				4.90	0.87	0.57	0.72			0.79	1.60	0.08	
Lincoln		0.25	0.05				0.20		0.56	0.25	0.65		
Lisbon	0.50		T.	4.50	T.	1.25							
Luray	1.10	0.31	0.01	1.50	1.55	4.00	0.00	3.40	1.05	2.80	[1.50]	[0.10]	[17.32]
McAllaster	0.25	0.30	0.05	5.65		2.50	1.50	1.30	0.20	1.00	0.75	0.10	
Macksville	1.25	0.38	[0.50]	3.50	1.12	5.63	0.25	5.25	1.25	1.06	0.55	0.25	[20.99]
McPherson	1.90							4.65		1.83	0.91	1.22	
Manhattan[1]	2.71	0.33	0.16	1.96	2.13	2.43	3.37	5.93	3.51	2.02	1.01	0.57	26.13
Manhattan[2]	2.31	0.24	0.13	1.74	1.81	1.85	2.89	5.73	3.24	1.99	0.91	0.18	23.02
Manhattan[3]	2.23	0.29	0.22	1.82	2.18	2.09	3.68	6.04	3.18	1.98	1.03	0.25	24.99
Mankato	2.10	0.08	0.00	0.62	0.75			3.92	1.00			0.06	
Marmaton	3.73	1.00	1.38	2.26	[4.00]	2.42	[1.90]	9.33	4.65	2.73	2.37	1.30	
Minneapolis	1.35	0.20	0.07	1.56	1.90	2.90	0.10	7.72	0.90	0.00	0.80	T.	17.50
Monument	0.35	0.20	0.05	3.87	1.25	2.75	1.08	0.26	1.75	0.75	0.90	0.25	13.46

Morse	2.00	0.59	0.92	3.71	4.31	2.69	2.54	7.15	4.00	4.99	3.18	1.00	37.08
Norton						4.01	0.60	1.76	0.23	0.40	1.06		
Oakley	0.25	0.40	0.02	[2.50]	[1.60]	1.00	0.45	0.75	1.10	0.25	0.20	T.	[8.52]
Oberlin	0.40	0.16	0.00	3.70	0.99	3.06	1.92	1.65	1.05	0.75	1.15	0.00	14.83
Offerle	1.15	0.57	T.	4.62	3.38	3.07	0.10	4.68	1.10	[0.80]	[0.50]	[0.10]	[20.07]
Ogallah	0.50	0.57	[0.10]	4.00	0.25	2.00	4.50	3.40	2.20	0.80	0.10	T.	[18.42]
Oswego	2.70	1.00	0.63	4.20	5.06	1.26	0.87	8.12	3.79	5.25	3.65	2.00	38.53
Quenemo	2.62	0.20	0.05	4.20	3.22	2.15	1.50	2.26	[0.44]	[5.00]	3.25	[1.00]	[25.89]
Quinter	0.65	0.30	0.02	2.24	[0.70]	0.75	3.00	1.00	0.50	1.50	0.40	0.00	[11.06]
Richfield	1.00	0.12	0.25	6.02									
Rome	2.39	0.28	0.17	3.34	2.30	1.29	0.89	4.51	2.41	1.36	2.40	0.80	22.14
Salina	1.76	0.45	0.16	2.91	2.15	2.85	0.30	4.77	0.69	1.33	0.70	T.	18.07
Scott City	0.45	0.20			1.07				2.00			0.00	
Sedan	2.60	0.54	1.12	3.35	3.74	4.73	2.37	3.76	1.52	2.97	4.42	1.22	32.34
Seneca	2.10	0.22	0.61	0.77					1.91	1.58	1.29	0.02	
Sharon Springs	0.30			1.80	0.50	2.41	0.37	1.50	0.40			0.00	
Shields	0.33	0.50	T.	3.98	1.03	1.37	0.44	2.30	2.12	[0.05]	1.10	T.	[13.22]
Topeka	2.55	0.44	0.35	1.89	3.50	1.60	2.30	5.60	4.65	2.62	1.57	0.91	27.97
Tribune	0.20	0.20	T.	6.28	0.85	0.59	0.86	0.60	1.36	0.65	0.40	T.	11.99
Wakeeney	0.20	0.45			0.16	1.10	2.32	2.75	0.46	0.16			
Wakefield	2.24	0.08	0.42	2.36	1.37	1.82	0.80	8.22	3.05	2.59	1.07	0.05	24.07
Wallace[4]	0.06	0.17	0.00	6.25	0.56	1.49	0.82	0.83	[0.20]	[0.10]	[0.02]	0.00	[10.50]
Wallace[5]									0.20	0.10	0.02	0.00	
Wellington	2.40	0.45	0.38	[3.30]	2.97	0.48	0.46	2.90	2.86	2.63	3.14	0.79	[22.76]
Weskan	0.10	0.30	0.05	4.60	1.40	1.40	0.50	0.50	0.50	0.40	0.05	0.00	9.80
Wichita	2.12	0.35	0.14	3.63	2.17	5.05	0.95	2.60	1.96	2.39	1.72	0.99	24.07
Wilson	1.14	0.35	0.09	1.61				1.25					
Winona	0.32	0.35	T.	6.20	1.00	2.00	0.50	0.10	[0.20]	[0.88]	[0.25]	0.00	[11.80]
Yates Center	2.25	0.76	1.15	2.25	4.91	4.39	1.36	6.38	1.75	3.51	4.37	1.17	34.25
Kentucky:													
Bowling Green	7.03	12.50	8.74	3.56	2.69	2.50	3.16	7.99	2.42	4.39	3.58	4.45	63.01
Burnside	4.92	13.33	7.26	5.47	7.12	5.22	2.26	7.58	4.60	3.06	1.78	4.72	67.32
Caddo	[6.50]	3.38	4.70	[2.90]	2.43	6.65	2.40	5.20	2.10	3.33	2.90	2.23	[44.72]
Canton	6.50	8.36	7.10	4.89	3.64	1.20	1.13	7.26	2.62	2.10	5.80	3.20	53.80
Catlettsburg	3.32	5.95	7.85	6.46	7.27	5.04	3.35	7.70	7.29	3.89	3.27	3.96	65.35
Central City									1.97	2.07	5.36	3.80	
Earlington	6.60	7.27	6.72	2.66	4.39	2.67	1.29	5.95	2.67	2.00	6.40	3.23	51.85
Eddyville	5.81	7.09	4.47	3.08	3.46	3.91	0.48	6.72	3.41	1.44	5.67	2.63	48.17

[1] Signal Service river record. [2] C. M. Breese. [3] C. R. Blachley. [4] Signal Service rainfall station. [5] State weather service.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Kentucky—Continued.													
Edmonston								6.39	5.34	5.17	4.57	5.04	
Falmouth[1]	6.50	7.32	7.11	3.32	3.26	4.64	4.73	5.18	1.44	3.48	3.48	1.88	52.34
Frankfort[1]	6.47	8.18	7.95	3.96	4.91	4.94	4.50	3.22	1.65	2.93	5.20	3.80	57.71
Frankfort[2]	6.47	8.18	8.76	3.95	4.91	4.98	4.50	3.30	1.65	2.93	5.18	3.80	58.61
Franklin	7.91	9.42	10.53	3.41	4.30	3.40	2.49	7.64	2.43	3.86	4.05	4.27	63.71
Greensburg	5.69	12.35	6.09	3.31	5.45	3.79	1.40	4.71	3.81	3.58	4.51	4.54	59.23
Harrodsburg					5.70	6.25	5.92	7.94	2.83	2.85	4.00	3.94	
Lexington	5.34	8.13	9.91	3.59	4.71	7.43	3.14	7.32	1.82	2.38	3.54	4.05	61.36
Louisa	3.17	9.02	8.81	5.28	6.47	6.01	3.31	7.99	4.08	2.98	1.84	4.36	63.32
Louisville	5.73	6.25	9.58	3.51	3.15	6.96	2.05	4.18	2.71	3.69	4.54	3.06	55.41
Millersburg	5.04	7.27	7.20	5.44	4.16								
Mount Sterling	4.78	8.37	10.09	4.55	5.29	4.53	4.10	8.68	1.06	3.24	4.99	2.14	61.82
Murray	8.49	12.46	5.94			2.98	0.87						
Newport Barracks	5.30	4.62	6.58	2.75	3.32	6.76	1.75	5.62	3.25	4.37	2.87	0.69	47.88
Owenton	6.30	[d]7.30	9.60		2.70	5.30	4.30						
Paducah	6.82	8.35	5.23	4.62	4.42	0.84	1.33	7.12	2.61	3.77	7.56	2.81	54.98
Pellville	7.36	7.16	7.91	3.31	4.13	2.52	0.75	5.83	2.19	2.77	5.83	3.28	53.04
Princeton	7.55	10.77	7.52	3.80	4.77	4.30	2.80	5.09	4.81	2.15	7.70	3.53	64.79
Richmond	1.25	[a]5.08	7.92	4.14	4.06					2.71	3.01	3.59	
Shelbyville	7.12	7.63	10.60	3.71	3.85	9.66	3.69	5.34	1.69	3.28	5.14	3.74	65.45
South Fork	5.15	2.47	17.58	4.70		5.50	6.50						
Williamsburg	6.88	7.82	4.93	3.05	8.15	3.60	4.70	6.85	4.25	3.80	3.93	4.20	62.16
Louisiana:													
Abbeville	3.55	3.78	1.45	6.07	4.63	5.10	7.01	9.45	6.26	8.04	[1.70]	2.40	[59.44]
Alexandria	8.09	4.35	9.23	10.55	3.73	11.85	5.39	7.08	3.24	3.93	4.89	3.77	76.10
Amite City	1.43	4.69	6.16	9.11	4.62	4.52	6.73	5.78	6.17	3.57	2.67	6.08	61.53
Baton Rouge	1.67	3.66	3.34	9.86	6.39	3.67	6.09	5.10	3.00	6.09	0.68	2.52	52.07
Cameron	2.10	2.90	[illegible].73	8.54	4.60	5.40	6.95	3.60	2.82	4.61	4.76	1.37	50.38
Cheneyville	[5.30]	2.27	5.75	13.15	3.52	5.95	4.79	3.56	3.88	2.99	8.16	[8.20]	[67.52]
Clinton	1.95	6.82	6.66	9.02	2.37	[d]12.32	4.84	7.88	3.44	4.55	0.50	[d]1.90	62.25
Columbia	6.30	6.00	11.20	16.85	11.00	9.70	3.32	7.10					
Convent	0.51	2.78	3.81	5.63	4.82								

Coushatta[1]	8.64	5.99	4.92	10.75	3.91	7.56	3.46	1.49	6.06	4.91	1.48	1.93	61.10
Coushatta[3]	8.38	5.51	5.85	[10.75]	4.80	6.70	2.06	1.41	8.48	5.22	1.38	[1.93]	[62.47]
Crowley	2.57	3.86	3.19	9.93	3.69	9.14	3.29	2.70	8.53	7.52	[c]1.84	167	57.93
Delhi	1.89	5.78	4.55	9.17	3.79	5.35	3.90	6.39	6.00	3.50	2.00	3.35	54.67
Donaldsonville	1.46	3.16		4.87	6.62	5.33	7.66	10.27	1.26				
Edgard	0.70	2.84	3.07	4.78	5.47	9.87	8.75	7.20	2.04	4.52	0.28	3.36	52.88
Emilie	0.45	2.53	2.84	5.33	5.45	11.33	7.55	6.14	1.66	4.63	0.47	3.36	51.74
Farmerville	4.45	5.20	6.11	5.85	6.77	7.09	2.90	4.10	3.68	3.80	4.34	9.08	63.37
Girard	5.02	5.07	5.19	8.19	6.82	3.93	3.10	3.17	4.33	[j]1.55	[4.00]	[2.25]	[52.62]
Grand Cane	6.38	5.40	4.70	5.40	3.75	5.00	[3.40]	2.00	5.28	[4.00]	[3.15]	3.87	[52.33]
Grand Coteau	2.55	3.85	3.40	10.64	3.57	4.66	5.55	5.29	2.07	4.98	1.51	2.27	50.34
Hammond	1.33	3.43	4.20	11.16	5.48	5.54	9.18	5.00	3.79	[6.30]	[2.70]	[3.00]	[61.11]
Homer								4.59	5.41	2.90	3.47	4.94	
Houma	1.06	3.79	1.51	2.11	8.60	12.12	7.40	8.34	4.79	6.13	[1.00]	2.69	
Jackson Barracks	0.33	3.30	2.03	3.58	5.98	11.50	11.53	4.09	2.43	5.79	0.40	1.65	52.60
Jeanerette	1.83	2.95	2.60	11.16	5.87	12.06	6.96	7.90	3.04	[c]5.16	2.13	2.05	63.71
Jonesville	3.60	2.80	4.80			[g]4.75							
La Fayette	2.56	3.46	2.65	7.70	3.32	6.22	5.19	5.38	4.90	7.24	1.61	[2.30]	[52.53]
Lake Charles	3.30	2.55	6.05	6.20	7.20	5.00	3.15	5.55	6.70	3.50	7.20	1.70	58.10
Liberty Hill	5.86	4.44	5.63	7.70	4.59	7.17	1.90	2.22	6.79	5.79	3.12	1.91	57.12
Luling	1.10	3.49	2.53	3.68	11.54	8.73	7.08	5.05	4.09	6.23	[0.35]	4.62	[58.49]
Mandeville	1.12	1.82	2.87	5.73	4.60	5.98	5.60	0.07	0.87	3.48	1.08	1.75	42.97
Marksville	5.32	4.50	7.12	13.56	3.70	6.76	1.60	5.33	[2.30]	3.26	1.68	1.70	[56.83]
Maurepas	1.60	3.14	3.30	6.73	6.68	9.19	6.38	4.10	2.07	4.95	0.95	1.75	50.84
Melville	2.50	6.44	5.45	12.45	4.86	6.12	4.75	5.50	2.33	4.38	0.87	3.07	58.72]
Minden	3.22	2.23	1.17	[4.50]	4.73	5.75	1.76	1.17	10.63	4.24	3.05	4.46	[46.91]
Monroe	5.72	4.25	6.61	9.30	5.16	11.84	4.98	1.50	5.70	4.04	4.76	2.43	66.29
Natchitoches					6.34	5.32	3.05	2.01	3.61	5.92	3.15		
New Iberia	1.88	3.73	3.65	5.21	5.45	6.93	5.53	6.73	3.95	5.42	0.74	1.07	50.29
New Orleans	0.66	2.27	1.45	3.46	5.32	7.71	6.59	3.62	2.85	5.24	0.42	2.58	42.17
Paincourtville	[1.50]	[3.00]	3.15	4.61	5.64	7.69	7.29	6.73	2.81	5.66	0.49	[2.20]	[50.77]
Plaquemine	1.30	3.42	5.28	7.49	4.62	4.73	8.62	10.79	3.00	[6.00]	0.96	2.07	[58.28]
Port Eads	1.64	3.55	4.49	2.67	6.93	6.44	10.58	6.81					
Shell Beach	1.60	2.50	2.00	12.25	5.58	4.95	3.88	5.33	6.64	6.01	2.81	[1.80]	[55.35]
Shreveport	5.15	4.63	3.60	3.22	1.95	3.12	2.09	0.62	7.23	3.53	3.07	2.33	40.54
Sugar Ex. Station	1.00	3.10	1.98	3.27	10.19	4.55	7.30	7.75	3.56	4.41	0.87	3.55	51.53
Thibodeaux	0.61	2.05	2.11	2.21	4.62	6.25	6.76	6.15	3.17	5.92	0.46	2.23	42.54
Vidalia	3.91	8.69	9.31		3.59	5.76							

[1] Signal Service river station. [2] E. C. Went. [3] L. M. Howard.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Louisiana—Continued.													
West End	-------	-------	-------	-------	-------	-------	-------	5.10	3.80	2.65	0.77	-------	-------
Winnsboro	-------	-------	-------	-------	-------	2.94	0.17	3.24	-------	-------	1.09	2.11	-------
Maine:													
Bar Harbor	3.64	3.64	6.31	1.82	10.81	3.15	0.99	5.93	4.25	3.12	2.59	6.13	52.38
Calais	3.95	4.41	6.19	2.01	8.63	3.21	2.59	7.90	5.24	2.27	2.27	5.79	54.46
Cornish	3.45	4.43	5.65	2.26	6.66	6.58	5.95	4.12	9.08	6.11	2.66	3.68	60.63
Eastport	3.76	4.58	5.85	1.95	6.19	2.77	1.97	5.35	4.86	2.28	2.84	2.62	45.02
Fairfield	2.55	3.31	4.61	1.71	7.79	2.97	3.81	3.57	3.85	3.45	2.06	3.39	43.07
Farmington	1.32	5.42	4.08	1.74	7.76	3.12	3.20	5.18	4.80	3.77	2.29	2.53	45.21
Fort Preble	2.45	3.60	4.70	2.05	6.70	4.95	4.20	3.05	4.45	7.55	2.30	2.25	48.25
Gardiner	3.18	3.78	4.52	-------	7.84	-------	-------	-------	-------	-------	-------	-------	-------
Kennebec Arsenal	1.95	6.01	4.70	0.90	2.60	1.64	2.80	3.39	3.91	2.41	1.97	0.38	32.66
Kents Hill	1.85	3.56	3.38	1.88	6.94	4.64	3.87	5.07	4.42	3.99	2.26	3.68	45.54
Lewiston	3.00	4.14	5.88	2.17	7.51	3.71	4.83	3.47	5.13	5.47	1.89	5.55	52.75
Mayfield	-------	-------	-------	2.42	10.29	3.97	3.45	6.40	5.85	3.45	2.01	-------	-------
Orono	3.33	4.52	5.81	2.02	10.52	3.84	3.84	4.55	4.47	3.36	2.67	4.10	53.03
Portland	2.89	4.04	6.24	2.51	6.10	4.53	3.58	2.99	4.88	6.82	2.31	5.08	51.97
Maryland:													
Baltimore	1.80	4.80	4.07	3.94	5.98	2.42	3.61	6.44	4.76	5.73	0.74	2.67	46.96
Barren Creek Springs	1.51	2.95	5.89	3.90	3.43	1.59	1.88	8.89	4.71	8.32	0.90	4.05	48.02
Cumberland[1]	1.46	4.24	5.18	3.58	7.13	3.07	1.67	7.07	6.77	6.65	1.83	3.77	52.42
Cumberland[2]	1.48	3.66	4.94	3.51	7.51	3.16	1.73	5.53	6.30	5.96	1.42	3.52	48.72
Fallston	1.94	6.07	4.52	3.18	8.26	2.37	5.33	4.97	7.77	7.08	0.87	3.80	56.16
Fort McHenry	1.45	3.88	2.54	2.63	5.60	1.40	2.82	5.65	5.04	3.22	0.77	[2.70]	[37.70]
Frederick	1.15	4.02	3.57	3.75	7.01	1.88	3.49	7.45	3.72	5.54	0.76	2.18	44.52
Galena	1.63	3.69	4.75	3.34	3.90	1.60	-------	-------	-------	-------	-------	-------	-------
Jewell	1.52	5.55	3.45	2.00	4.84	1.84	3.17	4.45	5.88	4.91	0.75	5.65	44.01
Leonardtown	1.30	4.40	2.73	3.25	4.30	-------	-------	-------	-------	-------	-------	-------	-------
McDonogh	0.78	5.38	3.38	4.14	5.41	2.38	2.99	6.51	5.51	4.45	2.82	2.55	46.30
Mount St. Mary's	1.96	3.97	4.19	3.13	6.01	2.84	[2.80]	[5.50]	3.49	7.50	0.98	3.60	[45.97]
Woodstock	1.74	-------	2.74	3.72	5.44	1.22	2.57	7.88	5.95	4.43	0.86	2.30	-------

Massachusetts:													
Amherst[3]	3.34	3.08	5.25	1.67	5.31	1.89	5.56	5.54	6.08	6.98	1.34	3.15	49.19
Amherst[4]	2.61	4.01	4.81	1.64	5.14	1.48	5.44	4.60	5.28	6.89	1.24	3.18	46.32
Amherst[5]	2.61	[3.50]	5.37	1.73	5.39	1.53	5.63	4.88	5.85	7.13	1.32	2.86	[47.80]
Andover	------	------	5.28	------	5.07	4.38	1.87	------	4.12	8.90	1.50	2.69	------
Blue Hill (summit)	2.63	2.96	7.44	3.67	5.77	1.85	1.58	3.10	7.49	7.99	1.11	5.26	50.85
Blue Hill (base)	[2.58]	3.15	7.54	3.58	5.62	1.97	1.52	3.05	7.55	8.50	1.14	4.93	[51.13]
Blue Hill (valley)	2.53	2.40	7.64	3.10	5.58	1.90	1.55	2.82	6.80	8.06	1.11	5.24	48.73
Boston[6]	2.00	2.29	5.88	2.29	4.48	2.21	1.93	2.70	5.04	5.63	0.97	3.72	39.14
Boston[7]	2.54	3.05	6.49	2.78	5.42	2.53	1.75	3.00	6.12	7.92	1.11	3.82	46.53
Brewster	2.43	2.57	8.09	2.19	3.61	3.81	1.30	2.83	4.53	9.07	1.19	4.16	45.78
Cambridge[8]	1.97	2.85	6.63	2.03	5.06	2.80	1.42	2.86	3.70	8.09	1.15	5.15	43.71
Cambridge[9]	2.94	5.22	7.02	4.83	6.09	3.51	2.77	3.48	4.95	9.31	1.28	4.40	55.80
Chestnut Hill	2.52	3.12	7.64	2.93	5.80	2.60	2.43	3.37	4.89	8.78	1.37	4.76	50.21
Chicopee	2.84	4.24	[5.90]	2.44	5.94	[2.30]	5.43	5.43	11.14	6.99	1.72	[3.20]	[57.57]
Clinton	2.00	1.95	6.08	2.00	5.02	2.70	3.15	4.80	4.75	9.05	1.05	4.28	46.83
Concord	------	------	------	------	------	------	1.70	4.20	4.07	8.05	1.30	4.48	------
Cotuit	2.28	2.65	7.06	2.80	3.53	3.68	1.60	4.98	6.44	10.14	1.45	3.85	50.46
Dudley	1.69	3.00	6.60	2.10	5.60	1.70	3.57	5.67	5.33	5.19	0.88	3.34	44.67
Fall River[10]	2.91	3.18	9.63	4.23	5.80	3.76	1.90	4.80	5.73	10.47	1.39	4.67	58.47
Fall River[11]	------	3.37	10.31	4.64	6.30	------	2.19	------	------	------	------	------	------
Fiskdale	2.17	3.75	5.22	2.14	5.64	2.23	3.14	5.71	4.85	7.40	0.90	2.40	45.55
Fitchburg[12]	3.13	3.68	6.07	1.88	5.54	1.96	3.71	6.07	5.96	8.55	1.63	3.71	51.89
Fitchburg[13]	3.24	4.07	6.22	2.18	5.50	1.97	4.75	6.60	6.38	9.26	1.68	2.99	54.84
Fort Warren	1.36	2.84	3.87	2.69	8.40	2.95	1.11	3.30	5.00	6.46	1.07	2.44	41.79
Framingham	2.54	3.60	7.68	2.63	4.94	1.97	2.37	3.72	6.51	10.26	1.25	5.20	52.67
Gilbertville	3.42	2.96	5.15	3.00	6.09	2.17	4.76	7.96	6.76	7.94	1.68	3.75	55.64
Groton	2.85	3.84	5.11	2.17	5.01	3.08	4.20	6.37	6.50	9.63	1.57	3.28	53.61
Kendall Green	2.56	2.96	7.28	2.41	5.07	2.24	1.47	4.48	5.73	9.64	1.35	5.55	50.74
Lake Cochituate	2.34	3.26	7.30	2.51	5.31	1.78	2.31	3.34	6.47	10.11	1.24	5.26	51.23
Lawrence	2.47	3.50	6.51	1.80	5.54	3.71	2.62	5.03	4.13	8.68	1.63	4.86	50.58
Leicester	2.96	3.82	6.42	2.40	5.57	2.75	4.39	5.93	5.86	7.92	1.22	3.93	52.57
Leominster	2.98	3.91	6.10	2.22	5.43	2.66	4.62	6.05	6.34	8.83	1.56	3.48	54.18
Long Plain	3.07	3.16	6.11	4.12	8.00	5.01	3.07	4.52	7.83	10.66	1.52	5.47	62.54
Lowell	2.75	3.75	6.83	1.97	5.66	3.52	3.44	4.86	4.46	7.71	1.59	4.46	51.00

[1] E. T. Shriver.
[2] Howard Shriver.
[3] Miss S. C. Snell.
[4] Agricultural Experimental Station.
[5] Hatch Experimental Station.
[6] Signal Service.
[7] Boston waterworks.
[8] Harvard College Observatory.
[9] E. C. Brooks, civil engineer.
[10] C. V. S. Remington.
[11] Patrick Kiernan.
[12] Dr. J. Fisher.
[13] Dr. A. P. Mason.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Massachusetts—Continued.													
Ludlow[1]	3.40	4.19	5.27	2.44	5.19	1.84	5.10	5.91	7.03	6.22	1.51	3.41	51.51
Ludlow[2]	3.17	4.52	6.21	2.23	5.56	2.87	5.65	6.25	8.26	4.47	1.19	2.52	52.81
Lunn	2.51	4.69	[7.20]	2.59	5.43	2.80	1.60	5.62	5.68	7.36	1.48	5.39	[52.35]
Mansfield	4.15	3.80	8.45	4.40	6.54	1.26	2.00	4.79	4.77	7.59	0.95	5.02	55.72
Medford	2.51	3.35	6.13	2.48	5.71	3.53	2.07	3.64	3.49	8.92	1.36	4.14	47.33
Middlesborough	2.77	2.90	8.69	2.98	5.03	3.52	1.48	3.38	7.32	10.55	1.11	4.08	53.81
Milton	2.23	3.57	8.39	3.34	5.31	1.94	1.46	3.11	7.01	8.22	1.24	5.48	51.30
Monson	3.34	3.43	6.60	2.66	5.86	2.23	5.16	4.61	3.54	5.81	0.89	3.53	47.66
Mount Nonotuck	3.38	4.00	4.56	1.75	4.23	2.63	5.46	5.74	6.21	6.91	1.25	2.57	48.69
Mystic Lake	2.79	3.36	6.88	2.46	6.19	3.34	2.29	3.72	3.50	9.29	1.36	5.08	50.27
Mystic Station	2.47	3.25	6.29	2.13	5.83	3.22	2.19	3.56	3.50	8.39	1.36	4.27	47.06
Nahant						3.71	1.83	3.35	5.11				
Nantucket[3]	3.52	2.72	6.07	1.17	2.48	3.49	2.90	2.81	8.33	6.72	0.89	2.70	43.80
New Bedford	2.70	2.33	9.75	4.10	6.69	5.92	1.91	3.82	7.20	10.01	1.31	5.49	61.23
New Bedford[4]	2.78	2.65	8.17	3.65	6.52	5.53	1.98	3.75	7.73	9.73	1.30	5.02	59.01
Newburyport[5]	2.85	4.27	6.94	1.78	6.08	3.43	2.90	4.83	3.39	7.20	1.52	5.51	50.70
Newburyport[6]	1.45	4.76	4.45	2.01	6.88	2.10	2.08	3.14	3.50	7.63	0.82	2.91	41.73
Northampton	2.98	4.58	5.81	1.96	5.43	2.11	6.24	5.86	6.75	7.91	1.42	3.25	54.30
North Billerica	2.44	3.80	7.96	2.36	5.95	3.14	1.86	5.66	3.57	7.75	0.80	2.85	48.14
Plymouth	[3.00]	3.60	10.14	3.50	5.37	3.41	1.17	3.01	6.20	9.38	0.69	3.61	[53.08]
Princeton	[1.70]	2.60	[6.00]	2.28	4.58	2.02	4.38	5.90	5.57	10.04	1.48	[1.05]	[47.60]
Provincetown	[2.36]	2.92	6.96	3.14	2.99	3.46	1.76	2.81	7.62	6.78	[1.30]	3.48	[45.58]
Randolph	3.00	3.35	5.64	2.68	6.21	4.35	1.02	2.20	7.45	8.83	1.10	3.40	49.23
Roberts Dam	3.01	2.86	7.43	2.47	5.65	2.33	2.66	4.43	5.78	8.89	1.28	4.17	50.96
Royalston							6.50	10.75	10.38	11.62	3.50	1.46	
Salem	2.44	3.21	6.97	2.41	5.34	4.31	2.36	3.56	4.42	7.35	1.51	5.62	49.50
Somerset	2.24	2.93	9.61	3.83	5.81	4.58	3.26	3.45	5.19	9.61	1.04	4.17	55.72
South Hingham	[2.05]	3.45	8.00	3.78	5.54	3.41	1.87	3.48	5.75	10.81	1.50	4.90	[54.62]
Springfield Armory	2.67	4.07	6.36	2.21	5.36	1.83	4.69	5.59	11.14	6.70	1.11	3.15	54.88
Swampscott						1.18	2.21		4.64	6.17			
Taunton[7]	3.09	3.62	7.73	3.96	5.76	3.77	1.47	4.02	5.16	9.23	0.93	4.21	52.95
Taunton[8]	3.28	3.50	8.77	3.92	5.48	3.89	1.22	4.03	5.35	9.51	0.91	4.21	54.07

Taunton[9]	2.89	3.70	8.40	3.81	5.56	3.60	1.44	3.86	5.41	10.44	0.99	4.28	54.38
Vineyard Haven	2.27	2.32	8.76	2.21	2.86	3.51	2.32	5.05	3.54	6.30	1.22	2.54	42.90
Wakefield	2.50	3.61	7.49	2.33	6.51	3.13	1.80	4.21	4.06	8.58	1.53	5.62	51.37
Waltham	2.30	3.28	7.04	2.51	5.66	2.56	2.13	3.66	4.91	10.48	[1.37]	5.15	[51.05]
Wellesley	2.50	2.84	8.20	2.86	5.69	2.06	1.88	2.69	7.62	9.95	[0.66]	2.74	[49.69]
Westboro	2.42	3.62	6.82	2.62	4.41	1.76	2.43	3.53	3.92	10.85	1.07	4.17	47.62
Williamstown	3.41	3.92	4.06	1.46	4.68	1.72							
Winchester	2.60	3.39	5.66	2.49	6.41	3.42	2.27	3.56	3.18	8.39	1.41	4.26	47.04
Woods Holl	2.36	2.84	8.39	2.78	2.72	5.25	2.55	4.65	4.70	9.79	1.31	3.90	51.24
Worcester	3.08	[2.00]	8.47	2.56	5.59	2.89	3.40	6.76	5.52	9.24	1.72	4.45	[55.68]
Michigan:													
Adrian	5.15	3.02	1.65	3.90	5.14	2.61	1.44	5.01	4.06	7.44	3.75	1.89	45.06
Albion	4.53	2.26	3.49	4.93	5.79	4.84	0.33	4.06	2.08	5.00	2.64	1.31	41.26
Allegan	3.72	2.24	2.42	4.33	4.73	5.33	1.29	2.55	2.35	5.03	2.41	1.97	38.37
Alma	2.55	2.07	2.18	2.61	6.45	8.77	1.41	2.17	0.83	6.79	2.55	0.93	34.32
Alpena	3.77	2.23	2.07	4.20	3.74	1.83	2.54	3.11	0.97	3.03	2.18	1.68	31.35
Ann Arbor	3.11	1.38	1.69	3.90	5.19	3.34	0.93	4.86	1.56	5.26	3.15	0.98	35.35
Arbela	2.23	1.98	1.71	2.25	5.13	2.36	0.78	2.80	0.69	6.57	2.11	1.25	29.86
Atlantic	5.90	3.36	1.50	1.40	2.45	3.20	1.83	1.38	1.85	0.97	1.30	2.10	27.24
Ball Mountain	3.26	1.57	1.07	2.97	5.34	3.52	2.18	6.01	2.20	0.97	2.94	0.77	32.80
Bangor	3.30	2.35	2.93	4.05	4.78	5.27	0.90	1.94	2.33	7.39	2.61	2.47	40.32
Bear Lake	3.93	3.26	2.96	2.05	2.54	2.18	2.49	2.89	1.60	4.39	2.68	0.71	32.69
Bell Branch	2.21	2.03	0.98	4.22	3.85	3.29	0.69	4.35	[1.90]	5.99	2.48	0.70	[32.69]
Benton Harbor	2.84	2.07	2.77	3.99	4.31	5.24	2.60	2.48	2.17	7.36	2.51	1.28	39.62
Benzonia	4.58	2.57	3.61	2.23	2.41								
Berlin	2.71	1.82	2.45	3.13	6.21	5.56	1.73	3.58	2.35	11.02	2.68	1.15	44.39
Berrien Springs[10]	3.30	2.16	3.72	3.87	5.18	3.85	1.86	2.34	3.44	9.02	3.17	2.65	44.56
Berrien Springs[11]	2.72	2.18	4.03	[3.80]	5.13	3.78	1.90	2.37	3.56	7.27	2.64	2.81	[42.19]
Big Rapids	4.11	1.68	2.42	2.68	4.83		1.98						
Birmingham	3.74	1.88	1.48	3.03	3.92	2.16	1.14	5.62	1.63	6.42	3.17	1.10	35.29
Bronson	3.25	2.09	1.95	3.35	4.88	2.22	0.17	4.59	3.44	3.55	2.91	1.30	33.70
Buchanan	5.21	2.98	4.22	4.69	5.67	5.24							
Calumet	3.66	2.11	0.96	1.85	2.11	4.78	2.25	2.35	2.81	2.42	1.24	0.83	27.37
Caldwell (Manton)	3.40	2.60	2.90	3.78	3.08	1.99	2.47	3.66	0.94	3.58	2.70	1.30	32.40
Cassopolis	3.89	2.12	2.81	4.96	5.71	3.43	0.62	2.54	3.64	6.39	2.12	2.06	40.29
Charlevoix	1.68	1.70	0.89	1.87	3.16	2.69	1.22	3.12	2.50	5.55	1.70	3.80	29.88
Cheboygan	[4.50]	[2.60]	[0.80]	2.25	3.10	2.13	8.49	3.88	1.22	2.46	2.27	1.30	[35.00]

[1] M. W. Graves. [2] F. V. Pike. [3] T. T. Rodman. [4] J. Haviland. [5] Newburyport waterworks. [6] New Bedford waterworks. [7] E. U. Jones. [8] A. F. Sprague. [9] Taunton waterworks. [10] F. A. Zerby. [11] Wm. J. Jones.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Iichigan—Continued.													
Chelsea	3.87	1.85	2.13	5.55	6.90	4.32	2.30	2.60	1.80	4.05	[3.50]	1.15	[40.02
Clinton	2.96	2.13	2.39	3.48	4.89	1.84	0.49	3.59	1.90	4.89	2.28	1.05	31.89
Colon	4.08	2.26	2.63	4.30	6.67	4.31	0.24	4.47	2.91	3.96	2.02	1.47	39.32
Concord	3.43	1.73	2.12	4.10	5.14	2.64	0.46	2.70	2.18	4.84	1.95	1.24	32.55
Crawford	2.17	------	------	1.57	5.21	------	0.90	2.46	------	------	------	------	------
Crystal Falls	1.55	1.73	1.63	0.85	2.70	3.24	3.03	4.82	2.58	0.68	0.68	0.77	24.26
Detroit[1]	2.70	2.01	1.32	2.74	3.94	4.28	1.69	4.46	2.31	5.67	2.64	1.23	34.99
Detroit[2]	------	------	------	2.45	5.37	4.00	1.25	5.10	------	------	------	------	------
East Tawas	1.90	1.31	2.45	2.30	4.37	2.41	------	------	------	------	------	------	------
Eden	2.33	2.03	1.98	4.15	4.82	5.96	1.52	2.15	2.32	5.19	3.44	1.74	37.63
Escanaba	2.95	1.99	2.00	1.35	3.41	4.14	3.70	4.24	3.42	1.42	0.81	0.59	30.02
Evart	3.06	3.82	2.27	2.54	4.46	4.90	3.07	2.16	[1.20]	4.12	2.36	0.99	[34.95]
Fairview	1.63	1.83	1.08	3.71	4.86	3.74	0.07	2.38	1.84	[1.60	2.12	1.28	[26.14]
Fitchburg	5.44	2.26	2.42	4.75	4.97	4.58	1.22	3.43	2.77	5.76	3.26	1.35	42.21
Flint	2.24	0.77	0.68	2.39	5.02	2.36	0.83	2.96	1.74	[6.60]	[2.60]	0.93	[29.12]
Fort Brady	3.39	2.65	1.69	2.43	3.35	4.60	4.32	3.45	3.25	1.53	0.23	2.48	33.37
Fort Mackinac	2.46	1.72	0.34	1.48	1.99	3.99	4.52	3.74	3.08	3.04	1.72	0.42	28.50
Fort Wayne	2.94	2.07	1.42	3.22	5.28	3.99	1.64	4.70	3.21	5.82	3.13	1.02	38.44
Fremont	3.35	1.77	1.32	3.57	5.10	2.86	1.36	2.37	1.09	4.60	1.25	0.76	29.40
Gaylord	------	------	------	0.90	?1.80	1.75	------	0.75	1.66	1.63	1.65	1.60	------
Gladwin	3.35	1.69	0.85	1.00	2.77	2.28	[1.20]	[2.40]	[1.20]	2.89	0.68	0.53	[20.84]
Grand Haven	2.83	2.29	2.98	3.07	5.32	3.11	0.90	2.78	1.72	4.12	1.91	1.23	32.26
Grand Rapids	2.03	1.05	1.21	3.41	5.33	3.42	1.31	2.89	0.27	3.23	1.46	0.99	26.60
Grape	2.63	1.94	1.07	3.22	3.31	3.02	1.05	4.70	1.69	4.69	2.22	0.80	30.44
Grayling	3.22	2.62	1.80	3.28	3.37	2.61	3.56	4.14	1.05	3.21	1.90	1.75	32.51
Gulliver Lake	4.33	2.95	2.78	1.18	3.79	5.36	3.67	3.21	2.69	1.58	1.45	1.48	34.47
Hanover	4.22	1.78	1.73	3.49	5.14	3.81	0.07	3.25	3.10	4.29	2.50	1.50	34.88
Harbor Springs	------	------	------	2.23	3.41	2.26	0.66	2.43	2.24	2.63	------	1.05	------
Harrison	[3.60]	1.80	0.99	2.22	3.96	3.11	1.18	2.36	1.17	4.50	1.23	1.25	[27.37]
Harrisville	4.30	1.73	1.89	3.99	3.64	2.68	1.69	3.20	0.86	2.84	1.63	2.42	30.87
Hart	3.70	0.97	2.45	4.70	5.45	3.05	2.91	2.85	2.50	6.15	1.45	1.05	37.23
Hastings	3.05	2.00	2.73	3.64	4.61	5.94	0.56	4.30	2.25	3.93	2.48	0.87	36.36

Hayes	1.41	1.00	0.98	1.61	3.47	3.80	2.17	2.86	0.28	4.98	2.02	1.46	26.04
Highland Station	3.23	1.49	0.99	3.48	5.20	2.34	2.56	2.98	1.64	4.69	3.05	1.06	32.71
Hillman	4.14	2.20	1.30									0.68	
Hillsdale	3.58	1.75	1.82	3.13	4.91	2.59	0.21	2.90	2.75	5.71	2.79	0.81	32.95
Howell	[3.00]	[1.80]	1.07	3.39	5.12	3.20	1.22	2.57	1.84	5.34	3.55	1.58	[33.68]
Hudson	6.99	2.12	1.37	1.78	4.78	3.57	0.63	4.11	3.07	5.87	2.77	1.75	38.81
Ionia	2.75	2.57	2.45	1.62	5.17	2.52	2.65	2.25	[2.10]	4.41	2.49	1.58	[32.56]
Ivan	4.04	2.00	2.03	3.06	2.31	2.09	2.36	3.55	0.95	5.51	2.19	1.34	31.43
Jeddo	2.28	1.77	0.81	2.28	5.44	3.59	3.12	4.84	1.34	5.99	2.61	0.78	34.85
Kalamazoo	3.45	1.53	1.96	3.40	4.66	3.77	1.14	2.81	5.03	4.32	2.54	1.35	35.96
Lansing[1]	2.97	1.84	1.40	3.20	5.53	3.70	0.75	3.02	2.12	4.66	2.71	0.95	32.85
Lansing[3]	2.71	1.85	1.31	3.23	6.22	4.03	0.52	3.06	2.39	4.96	2.91	1.35	34.54
Lathrop	4.03	2.30	1.75	1.05	2.80	4.23	4.71	5.84	1.98	3.53	0.96	0.96	34.14
Madison	3.79	2.30	1.72	3.38	4.49	2.11	1.05	3.82	2.90	5.37	2.23	1.20	34.36
Manistee	5.64	2.55	2.64	3.93	3.17	3.03	2.34	2.69	1.12	5.59	2.53	1.02	36.25
Manton	3.40	2.60	2.90	3.78	3.08	1.98	3.10	3.66	0.94	3.58	2.70	1.30	33.02
Marquette	3.11	5.17	2.20	1.67	2.96	3.66	4.07	2.17	1.52	3.18	1.94	2.82	34.47
Marshall	3.14	1.83	2.24	4.66	5.35	3.85	0.63	5.02	2.16	6.03	2.70	1.60	39.21
May	2.31	2.10	1.49	2.04	5.82	3.71	0.72	3.53	0.80	5.76	2.13	1.28	31.69
Mio	2.19	2.79	1.92		2.89			2.92			1.75		
Montague	3.33	1.64	2.22	2.98	4.72	2.80	1.23	2.57	1.27	5.56	1.60	0.96	30.88
Mottville	3.53	1.99	2.39	3.52	5.28	5.21	0.20	1.83	3.73	5.56	1.60	1.12	35.96
Noble	3.41	1.92	3.56	3.50	4.50	3.62	0.30	3.69	4.02	3.70	2.16	1.47	35.85
North Aurelius	4.00	1.96							2.52	5.49	2.98	0.95	
North Marshall	4.04	1.69	0.90	4.45	6.12	4.16	0.26	3.61	2.19	4.50	2.84	1.52	36.28
North Port									1.20	2.81	1.67	2.24	
Olivet	2.38	1.78	1.70	3.33	4.60	2.77	1.48	3.63	3.15	4.58	2.28	1.11	32.79
Otsego	2.81	2.08	2.51	5.02	5.34	6.30	0.04	2.84	2.60	5.23	3.16	3.04	40.97
Ovid	2.13	1.63	1.44	2.77	5.30	3.78	1.40	2.15	1.45	6.22	2.20	1.16	31.63
Parkville	4.44	2.14	2.62	4.85	6.58	5.22	0.43	3.90	3.59	7.10	2.36	3.12	46.35
Paw Paw	3.49	1.91	2.30	3.21	5.46	4.29	0.16	1.40	3.14	5.94	1.87	1.54	34.71
Pontiac	3.17	1.97	1.94	3.68	5.72	5.04	1.94	5.27	2.35	6.76	3.02	1.42	42.28
Port Huron	3.11	1.76	1.43	2.46	4.30	4.72	0.96	4.33	1.23	4.92	2.42	1.31	32.95
Pulaski	3.17	1.98	2.24	2.42	4.96	3.45	0.06	2.86	2.35	4.80	2.16	1.19	21.64
Rawsonville	2.20	2.20	2.80	3.40	4.37	1.85	0.85	4.70	1.65	5.85	2.85	1.35	34.07
Romeo	2.63	1.26	1.61	3.30	6.30	2.98	2.39	[3.60]	1.38	7.93	2.86	[1.60]	[37.84]
Roscommon	4.27	2.77	2.20	5.35	3.60	2.63	2.00	2.83	0.93	2.70	3.27	2.00	35.55
St. Ignace	4.47	2.64	2.11	3.12	3.45	2.30	7.76	4.03	1.91	2.58	2.05	1.25	37.67

[1] Signal service. [2] Rev. J. E. Terborg. [3] Dr. H. B. Baker.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Michigan—Continued.													
St. Johns	2.23	1.94	2.07	2.62	4.26	4.67	2.43	2.61	0.76	4.59	1.83	1.03	31.04
Sand Beach	2.37	2.34	0.72	1.86	3.30	3.34	4.27	3.40	0.82	7.37	2.54	2.60	34.93
Sault de St. Marie	4.03	2.91	1.65	2.64	3.87	4.96	5.16	4.11	3.98	2.04	2.16	2.55	40.06
Standish	-----	-----	-----	-----	-----	-----	0.40	?	0.21	3.30	2.12	0.77	-----
Stanton	1.84	1.96	2.13	1.82	6.58	6.05	1.77	2.38	1.09	5.59	4.30	0.63	36.14
Stockbridge	3.38	1.85	1.21	3.86	4.56	2.98	0.95	3.28	2.59	4.59	2.58	1.56	33.39
Thornville	3.38	1.66	1.94	3.35	5.86	3.39	1.10	4.56	2.43	7.96	2.70	1.43	39.76
Vandalia	3.29	1.78	2.53	4.73	5.16	3.24	0.49	3.43	5.25	6.10	2.16	1.95	40.11
Vienna	4.21	2.04	2.21	4.66	2.98	2.57	2.48	3.64	2.00	2.58	2.25	0.77	32.45
Washington	2.76	1.58	1.98	2.77	4.98	2.68	1.69	7.41	1.61	6.47	2.47	0.60	37.00
Weldon Creek	4.80	2.78	3.39	2.57	3.06	2.89	1.57	1.28	1.52	5.89	1.57	1.64	32.96
West Branch	3.77	1.45	1.85	2.86	2.94	2.45	1.80	2.25	1.25	3.55	2.11	0.52	26.80
White Pigeon	-----	-----	-----	-----	-----	4.95	0.32	2.94	4.72	4.44	1.60	-----	-----
Williamston	3.22	1.80	1.90	3.45	6.15	5.07	1.95	3.05	1.85	5.47	2.93	1.60	38.44
Ypsilanti[1]	3.10	2.61	1.57	3.83	5.02	2.09	1.61	4.42	2.19	5.53	2.68	1.79	36.44
Ypsilanti[2]	2.70	1.82	1.36	3.14	4.50	2.17	1.90	4.13	1.88	5.44	2.38	0.94	32.36
Minnesota:													
Alexandria	0.43	0.23	0.85	0.69	2.39	7.97	1.68	2.05	1.58	2.61	0.81	0.89	22.18
Crookston	0.60	0.70	0.11	0.24	1.23	3.50	2.34	1.81	2.20	2.92	0.17	0.05	15.87
Duluth	0.87	1.09	1.16	1.75	2.24	3.33	3.51	3.62	2.39	3.03	0.91	0.19	24.09
Farmington	[0.46]	1.00	2.30	1.90	3.46	8.20	0.37	3.06	4.00	2.42	0.50	0.50	[28.17]
Fergus Falls	0.20	0.10	0.29	0.56	1.71	4.70	2.89	2.85	3.65	2.30	0.51	0.40	20.16
Fort Ripley	0.45	0.28	0.77	1.90	3.48	4.86	3.27	3.29	2.70	2.30	0.67	0.30	24.27
Fort Snelling	0.46	0.22	2.90	1.85	4.00	7.76	1.61	2.38	3.32	3.12	0.82	0.42	28.86
Grand Meadow	[1.00]	[0.90]	0.34	1.11	3.23	7.23	0.97	2.10	2.69	3.20	0.34	0.19	[23.30]
Lake Winnibegoshish	0.56	1.01	0.82	0.54	2.56	5.19	2.74	2.88	4.74	2.55	0.40	0.30	24.29
Leech Lake	0.63	0.95	0.63	1.20	3.43	5.01	5.29	2.29	3.44	2.59	0.41	0.17	26.04
Le Sueur	0.85	0.60	0.62	2.15	4.09	8.59	1.53	2.96	1.53	d2.40	0.85	0.04	26.21
Mankato	0.93	0.55	0.93	2.00	3.98	3.97	2.35	2.84	2.20	2.57	0.52	0.49	23.33
Medford	[1.00]	[1.00]	0.75	1.76	4.10	9.64	1.75	2.82	1.70	2.89	0.75	[0.49]	[28.65]
Minneapolis	1.04	1.28	1.68	1.75	4.16	5.97	1.90	2.59	3.35	2.46	0.39	0.50	27.07
Montevideo	0.34	0.21	0.79	1.41	2.94	8.11	1.88	1.64	1.61	1.90	0.43	0.19	21.45

Moorhead	0.26	0.40	0.56	0.19	1.42	6.60	3.59	3.69	2.62	2.10	0.31	0.05	21.79
Morris	0.10	0.02	1.11	0.60	1.83	4.38	4.00	2.32	1.06	1.64	0.50	0.18	17.74
Northfield	1.22	0.58	0.68	1.57	4.14	10.29	0.82	3.25	3.25	2.31	0.60	0.28	28.99
Ortonville	0.40	T.	0.70	0.39	1.15	8.36	0.88	2.23	1.23	0.93	0.50	0.30	17.07
Owatonna	1.12	0.61	0.62	0.60									
Pine River	0.55	0.42	0.63	2.31	2.98	2.56	2.39	2.80	1.90	2.62	0.34	0.18	19.68
Pokegama Falls	0.65	0.95	1.21	1.27	1.76	7.42	2.64	3.16	3.91	2.81	0.59	0.26	26.63
Red Wing	1.36	0.53	0.98	1.87	4.55	8.03	1.80	3.96	3.15	3.38	0.72	[0.15]	[30.48]
Redwood Falls	0.13	0.06	0.46	0.93	5.46	13.05	0.90	1.77	1.76	2.25	0.77	0.23	10.77
Rolling Green	0.70	0.50	1.62	2.95	5.65	7.78	0.25	2.49	1.69	2.15	0.30	0.53	26.61
St. Charles	1.05	0.80	0.50	2.27	3.67	12.00	1.15	3.60	3.97	4.10	1.00	0.30	34.41
St. Paul	0.95	0.50	1.11	1.80	3.66	5.29	1.87	2.20	2.73	2.79	0.38	0.10	23.38
St. Vincent	1.98	0.63	0.95	1.41	1.29	4.08	2.32	2.40	3.82	2.79	0.19	0.23	22.09
Sheldon	2.00	0.90	0.57	1.33	2.54	10.82	0.37	2.16	4.26	3.24	1.17	0.75	30.11
Tracy	0.24	0.10	0.27	0.82	4.88	6.19	0.35	1.82	1.24	0.71	0.04	0.10	16.76
Mississippi:													
Aberdeen					5.03	4.05	3.49	4.27	5.46	2.55	0.00		
Agricultural College	3.62	8.03	7.97	5.46	4.35	3.20	3.47	5.83	6.74	3.90	0.01	2.47	55.05
Batesville	6.15	5.95	7.15	3.90	7.26	2.83	1.65	3.86	4.00	2.84	2.49	3.15	51.23
Bay St. Louis									1.80	h2.18	1.00	6.30	
Booneville	5.78	11.23	7.10	4.35	3.64	4.75	4.91	[8.50]	8.35	[2.30]	3.18	2.89	[66.98]
Brookhaven	1.37	8.89	9.85	5.05	3.51	6.51	4.04	6.05	3.02	4.75	1.95	3.70	58.69
Canton	5.68	7.23	6.53	5.19	5.26	3.07	1.43	4.38	5.31	2.29	0.31	2.27	48.95
Columbus[3]	3.69	9.53	6.62	6.70	5.35		5.12	f7.75	8.82				
Columbus[4]	3.69	9.53	6.62	6.80	4.92	3.80	6.72	10.47	9.58	3.22	0.37	[2.40]	[68.12]
Corinth					4.33	2.30	4.60	8.47	12.57	2.34	1.75		
Edwards	3.84	5.62	5.68	6.68	7.09	3.32	5.22	5.21	6.17	2.93	0.60	2.39	54.75
Enterprise									6.95	4.36	0.35	3.04	
Fayette	4.03	7.59	7.63	9.04	5.30	4.13	4.28	5.49	2.86	2.70	2.52	3.74	59.31
Greenville	4.98	[5.40]	6.63	11.01	4.67	2.31	2.23	2.09	4.94	2.79	1.48	3.94	[52.47]
Hattiesburg				2.47	2.36	4.95	10.42	4.70	2.70	4.55	1.45	2.10	
Hazlehurst					4.20	4.62	3.22	7.26	4.36	3.93	0.98		
Hernando					6.11	3.35	0.46	4.10	6.40	1.36	4.31		
Holly Springs[5]	7.12	9.85	7.56	6.07	7.76	3.05	4.72	6.20	8.93	2.70	3.54	3.86	71.36
Holly Springs[4]	5.16				7.50	2.04	5.66	5.75	8.65	2.36	4.12		
Jackson	2.75	10.50	[6.70]	[5.90]	2.01	2.37	3.13	5.87	3.17	0.17	T.	[2.40]	[44.97]
Kosciusko	1.78	9.50	5.80	0.62	3.98	1.00?	3.05	5.00	7.80	2.30	0.60	5.40	46.83
Lake	3.27	7.56	6.65	4.57	4.86	3.66	1.97	3.29	1.39	1.10	T.	[2.60]	[40.92]

[1] J. C. Bemiss. [2] C. S. Woodard. [3] Miss H. Quinche. [4] Cotton Belt. [5] Dr. F. B. Shuford.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Mississippi—Continued.													
Logtown	1.64	2.91	2.24	4.88	4.06	4.88	9.02	5.58	5.80	3.46	4.32	2.31	51.10
Louisville	3.75	9.62	8.43	6.26	6.04	3.73	5.41	8.20	4.59	2.69	T.	3.39	62.11
Macon	g2.20	[4.30]	9.10	1.26	3.67	1.45	4.88	4.75	8.80	0.63	0.35	[1.70]	[43.09]
Meridian	2.73	7.78	4.32	4.43	7.42	3.13	3.37	4.94	7.54	3.48	0.40	2.21	51.75
Moss Point	0.62	2.15	4.10	3.60	5.97	6.72	10.02	7.90	6.03	6.31	0.00	1.75	55.17
Natchez[1]		7.27	10.05	9.07	3.65	5.58	2.29	7 05					
Natchez[2]					3.59	5.76	3.16	6.02	3.47	2.23	0.70		
Okolona	6.10	7.60	3.80	2.50	5.46	2.44	4.19	5.48	10.26	1.89	0.50	[2.30]	[52.52]
Palo Alto	4.59	9.18	8.93	6.21	6.37	3.04	4.36	6.83	8.84	2.77	0.03	3.37	64.52
Pearlington	1.64	2.91	2.30	4.88	4.06	5.07	10.74	5.58	3.07	3.59	4.34	2.55	50.73
Pontotoc	4.65	8.28	8.06	4.83	5.06	3.47	5.39	7.47	9.41	1.60	2.80	5.14	66.16
Port Gibson	4.15	3.80	5.60	6.57	4.58	3.02	3.78	5.30	4.12	2.62	1.15	[2.20]	[46.89]
Rienzi	[6.70]	12.11	8.12	2.06	3.17	5.37	4.05	5.18	8.69	3.09	2.08	4.48	
Summit	1.60	5.38	9.59	8.15							0.57	e1.48	•
University	7.26	7.55	7.83	4.84	7.30	2.79	2.99	5.43	4.79	3.01	2.93	3.97	60.69
Vaiden	[5.00]	10.41	8.86	7.26	4.99	4.40	4.62	10.01	4.17	1.82	1.33	2.66	[65.53]
Vicksburg	5.31	4.59	5.01	6.32	7.59	5.51	3.56	5.41	2.28	2.87	1.57	2.22	52.23
Washington	3.54	7.70	8.09	9.72	4.59	3.29	3.87	6.28	3.39	1.84	0.77	5.67	58.75
Water Valley	5.36	6.79	8.66	4.10	6.83	3.50	3.11	4.84	6.73	2.83	2.28	3.46	58.49
Waynesboro[1]	1.91	4.87	4.14	4.55	6.90	4.31	7.73	5.12	3.72	3.96	1.40	1.95	50.56
Waynesboro[2]					6.91	3.69	7.93	4.75	3.74	3.93	1.19		
West Point	[4.10]	[4.30]	7.09	3.12	3.47	2.41	2.78	4.09	6.26	2.92	T.	2.27	[42.81]
Yazoo City	5.54	7.95	5.15	5.65	5.99	4.17	2.18	5.77	3.96	2.44	1.00	3.63	53.43
Missouri:													
Adrian						4.17	1.78	5.26	3.86	2.45	3.03	0.77	
Annapolis	10.05	5.80	7.40	7.20	2.40	2.00	2.00	2.90	6.40	0.40	4.00	0.50	51.05
Appleton City	4.85	2.05	2.20	3.70	7.77	3.34	[6.20]	5.54	4.24	2.59	2.25	1.02	[45.75]
Austin						1.95	3.75	8.20	4.65	3.50	4.70	0.75	
Bethany	3.00	1.50	1.00	1.83	2.87	3.75	4.03	9.67	1.79	3.45	1.60	0.75	35.24
Boonville	2.81	2.30	3.79	2.89	3.05	2.48	3.95	3.19	4.83	1.64	1.51	0.31	32.75
Bradleyville						0.75	3.90	13.00		5.01			
Brunswick	2.25	1.20	2.20	1.90	1.50	2.65	4.50	7.10	5.50	4.65	2.90	0.70	37.05

California	------	------	------	------	*8.50?*	*1.50?*	*0.00*	*13.50?*	*13.50?*	*1.60*	*4.60*	*0.50*	------
Carrollton	------	------	------	------	------	------	4.92	5.14	2.08	5.19	3.06	1.57	------
Carthage	6.67	2.23	1.08	[3.50]	7.88	3.96	2.50	[10.00]	[12.00]	3.97	1.99	1.15	[56.93]
Cassville	------	------	------	------	8.09	2.12	3.94	8.44	6.77	5.13	2.84	1.98	------
Centerville	10.05	5.04	8.20	6.51	3.93	1.80	3.70	2.07	8.07	1.20	3.58	1.67	55.82
Columbia	4.02	2.34	2.80	2.17	3.92	3.40	4.97	5.47	3.97	2.10	2.34	0.38	37.88
Conception	3.32	1.04	0.82	1.03	1.18	2.70	2.15	6.28	2.70	3.23	1.20	1.00	26.65
Concordia	------	------	------	------	------	------	3.50	2.12	2.12	2.50	2.75	0.50	------
Craig	2.23	0.35	0.77	0.00	1.15	1.80	------	------	------	------	------	------	------
Dadeville	------	------	------	------	------	------	------	4.91	3.77	4.15	2.14	1.82	------
Eldon	------	------	------	------	4.38	1.37	4.00	9.00	6.63	0.88	1.23	0.63	------
Excelsior Springs	2.21	0.71	1.10	3.10	3.19	4.25	3.58	5.04	5.24	5.05	2.95	1.15	37.57
Fayette	2.96	1.68	2.73	2.17	2.62	1.38	3.01	3.21	2.35	2.30	1.83	0.40	26.64
Fox Creek	8.05	2.30	5.70	4.65	3.15	1.35	1.45	1.65	2.65	0.38	1.53	2.15	35.01
Frankford	2.47	1.89	3.30	1.82	------	------	------	------	------	------	------	------	------
Glasgow	2.35	1.68	2.41	2.22	2.48	1.59	2.91	3.84	4.48	2.65	2.41	0.95	29.97
Glenwood	------	------	------	------	------	3.77	2.78	4.57	5.20	------	1.54	------	------
Grand Pass	2.10	0.89	1.77	2.19	2.27	1.78	4.73	5.60	2.17	4.13	2.48	1.10	31.21
Hannibal	0.85	0.32	2.25	1.88	------	3.50	------	------	2.50	1.25	1.80	0.12	------
Harrisonville	2.25	0.46	1.66	1.63	5.25	2.35	1.42	4.19	3.53	2.37	3.46	0.53	29.10
Hermann	6.31	2.00	4.44	2.16	3.14	3.27	2.14	2.63	2.98	0.48	1.12	0.64	31.31
Ironton	10.50	5.00	8.45	7.00	3.75	1.40	6.85	5.55	8.40	1.50	3.55	1.20	63.15
Jefferson Barracks	6.30	3.85	4.51	4.72	3.75	1.22	1.17	3.50	2.40	0.90	2.10	0.90	35.32
Jerome	5.27	3.14	2.12	2.34	[2.80]	1.08	0.90	6.45	2.68	0.51	1.05	1.10	[29.44]
Jewell	1.52	5.55	3.45	2.00	4.84	1.84	3.17	4.45	[2.20]	4.91	0.75	[1.75]	[36.43]
Kansas City[4]	1.49	0.53	1.15	2.61	3.31	1.94	1.96	6.60	3.85	5.08	2.67	0.63	31.82
Kansas City[5]	2.19	0.83	1.50	2.73	5.50	2.00	3.36	6.67	3.98	4.71	2.78	0.40	36.65
Kidder	1.86	0.70	------	------	------	------	4.20	3.07	3.36	4.02	1.90	------	------
Kirksville	1.60	0.50	2.00	1.15	2.90	4.58	1.60	3.48	3.95	3.68	------	------	------
Laddonia	------	------	------	2.00	1.03	1.70	1.70	1.00	1.12	0.90	0.18	0.40	------
Lamar	------	------	------	------	4.19	1.50	4.52	7.88	5.78	2.94	------	------	------
Lamonte	2.01	------	------	2.40	1.14	0.37	------	------	------	1.02	1.48	0.50	------
Lamonte	2.65	[1.32]	1.55	1.25	2.49	0.97	7.60	3.73	2.12	1.75	2.13	1.00	[28.56]
Langdon	2.11	0.30	0.25	0.00	1.76	1.56	2.05	3.75	2.85	1.35	1.00	0.00	16.98
Lebanon	------	------	------	------	------	------	------	------	5.86	2.07	2.28	2.65	------
Liberty	------	------	------	------	------	------	------	------	4.65	3.46	2.55	1.81	------
Louisiana Bridge	3.37	1.14	2.16	1.77	2.94	2.78	0.48	1.67	2.36	3.07	1.45	0.20	23.39
McCune Station	------	------	------	------	------	0.00	0.00	0.50	2.41	1.08	1.19	0.85	------

[1] W. H. Swan. [2] Cotton Belt. [3] W. S. Darles. [4] Signal Service. [5] S. J. Spurgeon.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Missouri—Continued.													
Mexico	4.91	1.97	2.87	3.11	2.31	3.15	3.61	1.76	4.21	1.45	2.06	0.27	31.68
Miami[1]	2.39	1.24	0.30	2.42	------	------	4.54	9.28	3.80	4.21	3.31	0.76	------
Miami[2]	2.34	0.24	2.25	2.13	2.61	1.99	4.95	7.60	3.80	1.84	2.85	0.35	32.95
New Frankfort	2.81	2.20	------	------	2.80	1.85	6.30	5.63	5.38	3.30	------	------	------
New Haven	10.50	7.00	6.30	3.85	3.00	3.15	1.75	2.85	2.30	0.40	1.60	0.70	43.40
Oak Ridge	1.00	6.50	[3]14.20	6.95	3.50	0.70	1.70	3.00	5.90	2.00	4.05	2.08	51.58
Oregon	3.53	1.40	1.32	1.31	2.22	2.53	3.03	2.93	3.53	1.86	1.36	0.32	25.34
Ozark	4.50	2.70	3.70	3.20	------	------	------	------	------	------	------	------	------
Pickering	------	------	------	------	*h*6.50	8.25	2.13	5.50	1.95	2.07	0.89	T.	------
Platt River	------	------	------	------	------	------	1.00	2.77	3.03	3.09	1.56	2.05	------
Princeton	3.25	0.75	1.69	2.15	6.05	7.47	3.55	4.85	2.35	4.90	1.50	1.00	39.51
Saint Charles[4]	9.30	2.70	3.70	3.00	3.20	2.70	0.20	3.60	1.75	0.85	1.00	0.90	32.90
Saint Charles[5]	9.30	1.32	4.17	4.23	3.10	2.74	1.10	3.67	2.10	1.55	1.56	1.54	36.38
Saint Joseph	2.85	0.45	0.85	2.12	2.52	5.97	7.12	3.12	3.12	2.99	1.27	0.03	32.41
Saint Louis	7.47	2.86	5.99	4.05	5.81	3.18	0.37	2.43	1.80	0.86	1.55	1.32	37.69
Sarcoxie	------	------	------	------	3.53	4.90	4.87	15.39	14.41	4.05	2.89	1.30	------
Sedalia	3.68	1.76	1.74	2.20	4.27	1.11	5.50	3.37	2.71	2.07	1.89	1.72	32.02
Shelbina	2.60	0.50	2.70	2.60	2.10	3.30	2.50	1.70	2.60	3.40	2.40	1.70	28.10
Springfield	5.51	5.22	4.23	3.57	3.81	1.33	4.25	8.21	8.11	3.97	2.41	1.95	52.57
Steelville	7.00	2.45	4.50	5.71	1.61	2.60	1.10	6.20	3.95	1.23	0.83	1.35	38.53
Stellada (Windsor)	------	------	------	------	------	------	------	5.50	2.14	1.84	1.80	0.20	------
Warrensburg	2.57	1.27	2.03	1.51	3.76	1.00	3.06	6.69	2.56	2.25	2.92	1.33	30.95
Warrenton	[1.00]	[4.40]	3.40	4.05	3.70	2.26	1.48	[3.00]	2.20	0.89	1.22	0.66	[28.26]
Willow Springs	9.55	4.58	6.92	5.80	2.32	1.65	3.69	4.75	6.83	2.65	4.40	1.72	54.86
Windsor	5.20	0.40	3.20	9.20	7.10	7.60	6.60	5.50	2.14	1.84	1.80	0.58	51.16
Withers Mill	2.50	1.00	3.17	2.30	2.85	3.95	1.45	1.10	2.45	2.10	1.90	1.00	25.77
Montana:													
Blackfoot Agency	[0.30]	[0.75]	[c]0.52	[c]0.68	1.53	1.48	0.03	0.86	3.41	1.27	0.35	0.40	[11.58]
Camp Poplar River	0.79	0.10	0.34	0.36	1.77	3.79	0.73	0.04	1.81	1.25	0.13	0.09	11.20
Choteau	------	------	------	------	------	2.15	0.08	1.23	2.44	0.87	0.50	1.10	------
Custer	0.05	0.07	1.58	0.14	0.91	3.56	0.00	[0.30]	1.66	0.70	0.20	0.43	[9.60]

Fort Assinniboine [7]	1.05	0.69	0.11	0.11	0.80	2.01	0.58	1.26	1.87	0.47	0.17	0.25	10.37
Fort Custer [6]	0.31	0.24	1.18	0.56	1.03	2.44	0.06	0.31	1.72	0.98	0.48	0.35	9.66
Fort Custer [7]	0.31	0.24	1.18	0.55	1.03	2.36	0.06	0.30	1.72	0.98	1.61	0.35	10.69
Fort Keogh	0.28	0.40	0.69	0.11	0.82	5.40	0.05	0.03	2.12	0.75	0.37	0.50	11.52
Fort Logan	0.90	0.60	0.40	0.70	1.90	2.80	0.25	0.15	0.85	0.33	[0.50]	[1.20]	[10.58]
Fort Maginnis	0.88	0.58	1.80	1.30	1.69	h3.11							
Fort Missoula	0.73	1.70	1.13	0.87	1.92	3.10	0.32	1.05	0.76	0.60	0.60	0.61	13.39
Fort Shaw	0.30	0.43	0.48	0.06	1.85	1.41	0.70	2.40	1.40	2.20	0.61	0.47	12.31
Galpin	0.36	0.31	0.02	0.26	1.55	5.03							
Glendive	0.80	0.03	0.04	0.03	1.44	3.06	1.06	0.31	1.52	1.25	0.29	0.30	10.13
Helena	0.61	0.82	0.96	0.25	1.43	1.83	0.58	0.23	0.58	0.55	0.14	0.82	8.80
Kintyre	0.23	0.17	0.02	0.00	2.48	3.00							
Martinsdale	0.28	0.90	1.77	0.48	1.50	1.89	0.14	0.12	1.06	0.17	0.80	1.60	10.71
Powder River	0.50	0.49	1.09	0.51	1.55	3.84	0.40	0.68	0.83	1.20	0.30	1.00	12.39
Sheldon	2.40		1.04	0.17		3.10							
Virginia City	0.87	0.91	0.51	0.26	0.89	2.35	0.24	1.22	0.70	1.06	0.06	0.70	9.77
Woodworth							0.14						
Nebraska:													
Alliance	[0.50]	[0.40]	[0.30]	1.78	1.24	1.86	2.28	1.10	0.09	0.14	0.45	0.15	[10.29]
Ansley	0.40	0.20	1.20	3.50	3.40	2.60	1.00	3.00	1.10	2.60	0.75	T.	19.75
Ashland	0.94	0.31	[1.50]	0.96	4.34	4.92	4.58	3.07	1.51	1.09	1.43	0.50	[25.15]
Bassett					k1.50	3.10	2.76	2.10	0.23	0.41	0.85	T.	
Bingham	0.50	0.10	1.52	1.63		3.52							
Creighton	0.80	0.05	0.82	2.34	3.28	[0.48]	3.98	0.95	1.98	1.24	0.93	0.00	[16.85]
Crete [8]	1.27	0.18	1.35	1.31	3.46	4.48	2.47	2.93	1.14	1.64	1.42	0.30	21.95
Crete [9]	1.06	0.15	1.33	1.31	3.46	4.48	2.47	2.93	1.14	1.64	1.42	0.30	21.69
Culbertson [10]	0.28	0.16	0.05	5.09	0.65	3.42	0.78	2.89	0.04	0.33	0.47	0.00	14.16
Culbertson [11]				5.24	0.56	3.14	0.81						
David City	1.42	0.60	0.25	1.05	1.13	5.25	2.20	2.49	1.25	0.85	1.45	T.	17.94
De Soto	1.06	0.38	1.47	2.03	3.17	8.05	2.35	1.95	1.83	1.03	1.11	0.13	24.56
Fairbury	0.82	0.20	0.64	1.55	2.01	3.16	6.98	2.78	1.82	1.85	1.12	T.	22.93
Fairfield	2.00	[0.40]	0.16	1.43	1.51	3.81	1.82	3.95	0.34	1.11	1.23	0.28	[18.04]
Fort Niobrara	0.38	0.57	1.31	1.00	2.43	3.00	3.25	1.45	0.15	0.60	0.50	0.15	14.79
Fort Omaha	1.22	0.70	1.97	1.51	2.75	6.15	2.00	1.02	3.00	0.90	1.15	0.08	22.45
Fort Robinson	0.29	0.66	1.54	1.82	2.51	0.60	2.30	1.84	0.00	0.06	0.13	0.01	11.76
Fort Sidney	0.34	0.41	0.00	2.77	1.07	0.68	1.16	0.28	0.00	0.73	0.00	0.17	[7.61]
Franklin	0.20			0.25	1.20					0.76	0.73	0.81	

[1] Robert Ruxton. [2] Dr. A. W. Sullivan. [3] Estimated. [4] Dr. J. R. Mudd. [5] L. C. Saeger. [6] Signal Service. [7] United States post surgeon. [8] G. I. Gilbert. [9] G. A. Loveland. [10] Signal Service rainfall station. [11] Mrs. L. A. Wibley.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Nebraska—Continued.													
Fremont	1.51	0.61	1 61	0.92	2.67	6.99	4.14	1.33	2.31	0.53	0.66	0.08	23.36
Geneva	------	------	------	------	------	------	------	------	0.10	2.20	1.50	0.50	------
Geona	1.31	0.44	1.16	1.31	3.40	4.38	1.51	2.66	3.84	1.23	1.07	0.00	22.31
Gering	[0.30]	0.43	0.37	3.19	1.95	0.62	1.75	1.41	T.	0.16	0.56	0.27	[11.01]
Grand Island	0.55	0.20	0.23	1.12	1.32	[2.50]	0.55	2.72	1.27	0.64	1.05	T.	[12.15]
Grant	------	------	T.	4.26	1.18	4.61	1.20	1.55	0.05	0.41	0.40	0.20	------
Hastings	------	------	------	------	------	------	------	2.36	0.50	0.75	1.75	0.25	------
Hay Springs	0.61	0.40	1.01	1.73	2.24	4.55	2.75	1.27	T.	0.43	0.61	0.35	15.95
Hebron	[0.90]	[0.15]	[0.60]	2.80	1.05	3.45	4.72	2.62	1.70	2.37	1.45	0.00	[21.81]
Holdrege	------	------	------	------	------	1.71	0.75	1.00	0.45	0.40	1.00	0.00	------
Howe	2.08	3.00	4.12	0.80	3.49	3.75	4.21	2.79	2.78	1.54	0.85	0.00	------
Imperial	------	------	------	------	------	3.24	0.62	2.25	0.00	0.00	0.20	------	------
Kennedy	0.60	0.31	0.82	1.41	2.57	6.66	2.82	1.52	0.07	0.81	0.20	0.08	17.87
Kimball	[0.30]	T.	T.	2.49	0.87	0.75	1.80	2.05	[0.00]	0.58	[0.30]	0.53	[9.67]
Lexington	0.74	0.10	0.16	2.13	1.55	2.46	1.22	1.59	0.07	1.01	1.14	T.	12.17
Lincoln	0.86	0.40	0.72	0.32	2.70	3.14	1.72	1.84	0.98	1.12	0.60	0.00	14.41
Long Pine	------	------	------	------	------	------	3.50	2.60	1.00	0.25	1.50	0.70	------
Marquette	0.98	0.42	0.47	0.44	1.22	2.60	0.96	1.92	1.54	0.45	0.84	T.	11.84
Minden	1.32	0.35	0.93	[2.00]	2.36	4.55	1.45	1.33	1.30	0.30	1.30	0.00	[17.19]
Mullen	0.50	0.40	0.41	------	3.06	------	4.01	1.32	------	------	------	------	------
Nebraska City	1.30	0.40	1.51	0.64	2.80	5.21	2.50	4.02	2.73	1.49	1.39	0.00	23.99
North Loup	1.25	0.05	0.70	1.68	4.63	3.63	0.42	2.86	1.59	2.13	0.37	0.00	19.31
North Platte	0.35	0.38	0.27	4.46	0.90	2.06	0.39	2.42	0.19	0.84	0.42	0.03	12.71
Oakdale	0.85	0.41	1.38	1.69	3.00	3.23	1.24	1.62	0.82	2.39	0.85	0.01	17.49
Omaha	1.44	0.54	1.35	1.55	2.72	5.04	3.74	1.02	2.50	1.09	1.01	0.08	22.08
O'Neill	------	------	------	------	------	3.28	2.37	3.17	0.11	0.68	0.35	0.00	------
Ough	------	------	------	------	------	1.82	1.20	------	0.00	0.00	0.30	------	------
Palmer	2.00	0.40	0.40	0.60	2.00	2.40	0.45	0.80	0.80	0.70	0.80	0.00	11.35
Paxter	------	------	------	------	^{h}0.84	------	1.10	2.95	1.40	0.04	------	------	------
Plattsmouth	1.55	0.25	1.40	1.60	4.86	6.45	5.47	5.39	3.85	2.25	[1.00]	0.00	[34.07]
Precept (Forest Home)	0.28	0.18	0.00	2.11	1.56	4.29	1.05	3.69	0.06	0.87	1.19	0.00	15.28
Ravenna	1.83	0.52	0.83	2.76	2.85	2.75	1.66	1.98	0.86	2.04	1.03	0.04	19.15

Sargent		0.55	0.76	1.67				3.64	0.71	1.24	0.49	0.00	
Syracuse	1.09	0.31	1.24	0.93	2.87	4.00	3.17	2.83	2.47	1.28	1.23	0.00	21.42
Tecumseh	1.10	0.40	1.10	1.45	3.30	1.33	3.97	1.76	2.68	1.52	1.25	0.25	20.11
Tekamah	[1.00]	[0.30]	2.60	2.16	2.78	[8.00]	1.86	2.96	1.18	1.50	1.35	0.00	[25.69]
Thedford						2.00	0.73	2.02	0.79				
Valentine	0.69	1.49	2.28	1.33	1.91	3.09	4.39	2.04	0.68	0.64	0.93	0.32	19.79
Weeping Water	1.24	0.49	1.50	0.99	5.85	5.61	2.50	5.36	0.99	0.62	1.87	T.	27.02
West Hill	0.80	0.30	1.07	0.31	3.06	4.36	1.36	2.41	3.62	1.80	0.96	0.00	20.05
Weston	0.77	0.21	1.68	0.57	3.16	6.91	3.51						
West Point	1.18	0.50	2.00	0.70	6.75	8.95	1.25	2.50	1.15	2.76	1.31	0.10	29.15
Wilcox				1.65	0.97	5.09	1.65	1.37	1.65	0.22	1.05	0.10	
Nevada:													
Austin	3.64	1.82	2.98	1.26	1.48	0.05	0.30	1.16	0.45	0.60	0.10	1.10	14.95
Battle Mountain	2.55	0.50	0.81	0.95	[1.80]	0.00	0.00	0.90	0.00	0.00	0.00	0.30	[7.81]
Belmont	2.00	0.81	0.77	[2.00]	1.18	T.	0.13	0.94	1.75	0.32	0.09	1.58	[11.57]
Beowawe[1]	3.60	1.00	0.96	0.70	1.76	0.00	0.00	0.44	0.36	0.00	0.00	3.00	11.82
Browns	1.65	1.40	0.72	0.36	0.88	0.00	0.00	0.00	0.00	1.05	0.00	0.31	6.37
Candelaria	2.04	0.38	T.	0.00	0.35	0.00	T.	1.19	0.96	0.25	0.00	0.23	5.40
Carlin	2.35	1.45	1.70	1.10	1.60	0.00	0.00	0.30	0.10	0.00	0.00	0.60	9.20
Carson City[2]	4.97	2.39	0.83	0.17	0.43	T.	0.00	1.15	1.01	0.03	T.	2.29	13.27
Carson City[3]	5.29	2.32	1.12	0.15	0.43	T.	0.00	1.13	1.01	0.03	0.01	2.31	13.80
Columbus Marsh	[2.00]	0.35	0.00	T.	[0.60]	0.00	T.	3.44	0.70	0.50	0.00	0.50	[8.09]
Crane's Ranch	1.97	1.17	3.14	0.70	2.09	0.21	0.80	0.78	0.28	0.11	0.00	0.84	12.09
Downeyville	3.22	0.02	0.68	2.11	1.39	T.	T.	0.57	0.71	1.25	T.	0.36	10.31
El Dorado Cañon	0.49	0.55	0.50	0.05	T.	0.00	0.43	1.20	0.60	T.	1.41	0.81	6.04
Elko	[2.40]	1.10	2.15	1.41	1.17	0.00	0.60	0.00	0.12	[0.00]	0.00	0.00	[8.95]
Elko[4]	5.53	2.33	2.92	1.14	1.90		0.77						
Ely	1.39	0.85	0.90	0.90	0.70	0.00	T.	1.26	0.18	0.37	0.00	0.61	7.16
Eureka	2.87	1.10	2.61	1.08	1.72	T.	0.25	[1.00]	[0.15]	[0.00]	0.04	0.16	[10.98]
Fenelon	3.35	3.45	2.00	[5.00]	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	[14.98]
Genoa	6.02	2.33	3.80	0.00	0.70	0.00	0.00	0.15	0.46	0.00	[0.00]	[0.90]	[14.36]
Golconda	1.90	0.42	0.66	0.10	2.42	0.00	0.00	0.00	0.25	0.15	0.00	0.48	6.38
Gold Mountain	0.62	T.	0.03	0.01	0.58	0.00	0.02	1.04	0.33	[0.00]	[0.30]	[0.70]	[3.63]
Halleck	0.92	1.65	1.35	0.04	1.00	0.13	0.00	0.16	0.13	0.00	0.00	0.83	6.21
Hortons Ranch	0.90	0.00	0.30	0.03	0.20	0.00	0.21						
Hawthorne[2]	2.22	0.67	1.10	[0.00]	0.17	0.00	T.	1.03	0.46	0.50	0.00	0.40	[6.55]
Hawthorne[3]			0.07							*h*0.12	0.00	0.40	

[1] Pacific Railroad system. [2] Signal Service. [3] Charles W. Friend. [4] C. H. Sproule.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Nevada—Continued.													
Hot Springs[1]	2.10	0.55	0.05	0.04	0.07	0.00	0.00	[0.20]	[1.20]	0.01	T.	1.00	[5.22]
Hot Springs[2]	2.10	0.55	0.00	0.04	0.07	0.00	0.00	[0.20]	[1.20]	0.01	T.	1.00	[5.17]
Humboldt[1]	3.15	1.32	2.70	1.37	2.01	0.00	0.00	0.00	0.30	0.50	0.00	0.50	11.85
Lewers Ranch	8.23	3.06	4.39	0.28	1.04	0.00	0.00	1.42	1.28	0.05	0.29	3.55	23.59
Mill City	4.80	......	3.15	......	......	......	0.00	0.40	1.00	......	......	0.99	......
Palisade[1]	2.50	1.70	3.25	1.00	1.70	0.00	0.00	0.35	0.15	0.25	0.20	0.90	12.00
Palmetto	[0.60]	1.00	0.69	0.50	0.21	0.00	1.60	2.40	1.67	T.	0.25	0.75	[9.67]
Pioche	3.52	1.30	0.80	2.20	1.00	0.25	1.15	2.45	1.70	0.88	0.07	0.82	16.14
Punch Bowl	......	......	0.20	0.12	0.05	0.00	0.00	0.19	0.16	0.00	......	......	......
Reno[1]	1.14	1.75	0.80	0.16	0.31	0.00	0.00	0.00	0.90	0.00	0.00	1.30	6.36
Reno[3]	6.71	3.91	0.39	0.30	1.44	0.01	0.00	0.16	......	0.05	0.00	......	......
Ruby Hill	9.30	4.80	3.70	2.60	0.50	0.30	T.	......	......	......	......	......	......
Sodaville	3.21	0.60	0.02	0.00	1.50	0.00	T.	1.23	0.89	[1.20]	[0.00]	[0.35]	[9.00]
Tecoma	1.70	1.30	0.00	0.15	1.40	0.25	0.70	0.60	0.00	0.39	0.00	0.15	6.64
Toano	2.35	1.86	1.50	0.71	2.44	0.25	0.00	0.70	[0.00]	0.15	0.00	[0.16]	[10.12]
Tuscarora	3.42	2.77	3.75	0.50	......	0.15	T.	1.90	......	......	......	......	......
Tubo	......	......	......	......	......	......	T.	2.42	1.51	0.41	0.10	......	......
Verdi	9.11	1.74	2.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	T.	0.33	13.28
Virginia City	6.66	3.19	0.70	0.45	1.27	0.00	[0.00]	0.29	1.45	0.25	0.03	3.07	[17.36]
Wadsworth	1.95	0.70	0.28	0.04	1.10	0.00	0.00	0.00	1.55	0.50	0.05	0.61	6.78
Wells	2.10	1.41	0.61	0.05	1.32	0.05	0.00	0.20	0.00	0.05	0.05	0.16	6.00
Winnemucca[4]	2.96	1.48	2.87	0.68	1.30	0.07	0.01	0.24	0.47	0.17	0.00	1.02	11.27
Winnemucca[1]	3.37	0.55	[2.87]	0.62	0.55	0.00	0.00	0.15	0.30	0.49	0.00	1.05	[9.95]
Younts Ranch	0.40	0.20	0.20	0.00	0.00	0.00	0.40	1.30	1.60	0.00	1.50	0.69	6.29
New Hampshire:													
Antrim	3.20	3.21	5.01	1.57	4.73	2.00	4.56	5.48	4.77	5.75	1.55	3.53	45.36
Belmont	4.22	[4.00]	5.64	1.81	5.78	1.65	4.00	5.39	4.67	6.52	1.68	4.41	[49.77]
Berlin Mills	4.14	4.84	3.48	1.94	5.57	4.29	4.09	9.19	2.86	3.29	3.25	4.40	51.34
Concord	2.98	4.20	5.67	1.88	5.05	2.56	3.98	3.56	4.65	7.76	1.49	3.83	47.61
East Canterbury	2.17	3.96	5.03	1.74	5.78	2.77	5.84	4.80	5.34	7.15	1.69	3.42	49.69
Hanover[5]	2.48	2.75	3.24	1.57	5.40	2.63	3.85	7.77	3.99	4.75	1.71	4.66	44.80
Hanover[6]	2.65	2.96	3.41	1.88	5.02	2.70	3.23	7.69	3.91	5.14	1.86	2.80	43.25

Lake Village	3.76	4.28	5.21	2.01	6.39	2.71	4.58	4.99	6.23	6.16	1.83	4.97	53.12
Littleton	------	------	------	------	------	------	------	6.91	4.03	4.62	2.83	2.88	------
Manchester[4]	3.02	3.96	5.73	1.76	4.54	3.66	2.91	4.57	4.71	6.19	1.35	3.30	45.70
Manchester[7]	3.65	4.80	6.03	1.83	6.00	4.15	3.02	4.76	5.09	6.23	1.39	3.37	50.32
Mine Falls	2.71	4.10	6.50	1.60	5.32	2.61	4.34	5.85	7.01	8.10	1.52	4.55	54.21
Nashua	2.57	4.21	7.11	1.42	4.88	3.39	3.85	5.86	6.01	7.39	1.30	5.03	53.02
Newton	2.58	3.51	5.61	1.43	6.09	3.06	4.07	4.24	3.14	7.99	1.40	4.23	47.35
North Conway	3.07	3.96	2.76	[2.00]	5.32	4.21	4.72	6.05	5.24	5.60	1.72	5.98	[50.63]
North Sutton	3.84	3.49	3.71	1.85	4.85	2.95	4.45	5.35	3.04	6.69	1.54	3.10	43.86
Pennichuck Station	2.56	4.30	6.48	1.42	4.59	3.46	4.50	6.60	6.04	7.29	1.22	4.68	53.14
Plymouth	3.85	4.82	4.41	2.19	6.24	2.95	4.46	5.60	5.63	4.93	2.05	3.94	51.07
Stratford	3.33	2.89	3.06	1.47	7.00	3.88	3.04	6.46	3.18	3.19	3.30	2.90	43.70
Walpole	3.12	4.12	4.68	1.78	4.76	3.39	4.26	6.10	5.31	5.83	0.45	3.91	47.71
Weirs Bridge	4.07	4.12	4.90	2.28	6.34	2.37	4.76	5.60	6.91	4.32	1.60	4.87	52.14
West Milan	4.66	1.97	3.90	1.14	5.91	6.46	3.08	7.06	3.21	3.68	3.66	3.76	48.49
Wolfboro	3.20	[4.00]	5.09	1.57	6.77	3.81	4.72	4.54	5.98	7.20	1.99	3.92	[52.79]
New Jersey:													
Asbury Park	1.05	3.74	7.16	3.10	3.83	3.17	6.95	5.61	4.70	8.12	0.88	2.72	51.03
Atlantic City	1.27	2.43	5.20	3.86	5.81	2.99	5.46	7.51	5.01	4.05	0.38	3.33	47.30
Belleville	2.95	5.10	6.80	2.25	5.81	4.03	6.25	5.50	5.35	8.20	0.85	4.37	57.46
Beverly	1.99	3.83	6.67	2.25	4.46	3.42	4.92	5.60	3.97	6.50	1.07	3.40	48.08
Bridgeton	1.71	3.60	6.59	3.39	3.38	0.99	3.77	6.39	4.99	7.11	0.58	5.26	47.76
Cape May	[1.40]	3.11	4.33	2.99	4.09	1.58	3.59	3.52	4.80	4.58	0.52	4.43	[39.24]
Egg Harbor City	1.59	3.77	5.58	4.58	4.97	2.88	7.55	4.06	8.61	6.01	0.56	5.22	55.38
Freehold	2.53	4.25	6.43	2.68	4.28	3.58	6.06	3.68	9.97	9.96	0.96	5.13	59.51
Gillette	2.43	3.18	4.73	2.49	3.30	3.38	6.49	5.46	3.15	4.97	0.67	3.39	43.64
Highland Park	2.59	4.20	6.80	2.71	3.81	3.91	7.16	5.36	5.36	7.49	1.07	4.32	54.78
Hopewell	1.84	4.71	5.72	------	------	4.19	4.16	4.62	------	5.57	------	------	------
Imlaystown	2.08	4.70	4.14	2.45	5.98	4.80	6.97	3.36	6.26	9.65	0.98	4.44	54.07
Junction	2.32	4.64	6.15	4.24	2.97	3.81	5.60	5.04	3.49	2.17	0.78	3.07	46.02
Lambertville	3.05	3.78	6.27	2.38	4.93	4.96	5.27	4.99	3.10	5.35	0.84	2.34	47.26
Locktown	2.26	3.74	7.00	1.89	5.59	4.10	5.38	5.04	2.59	5.65	1.03	2.66	46.93
Madison	2.49	4.75	5.48	2.62	4.94	4.91	6.75	4.51	3.77	5.46	0.73	4.32	50.73
Moorestown	1.79	3.62	6.00	2.14	2.77	3.11	4.00	5.49	4.57	5.76	0.98	2.99	43.23
Newark[8]	2.54	4.27	6.61	2.10	4.19	4.44	5.40	5.20	5.13	6.49	0.78	3.71	50.86
Newark[9]	2.92	5.12	7.19	2.79	4.69	4.87	5.70	5.51	5.03	6.91	0.82	4.35	55.90
New Brunswick[10]	2.59	4.52	7.39	2.35	3.93	3.97	7.20	5.55	5.26	8.34	0.93	4.21	56.24

[1] Pacific Railroad System.
[2] Miss May Estabrook.
[3] W. S. Devol.
[4] Signal Service.
[5] Prof. E. B. Frost.
[6] N. H. Experiment Station.
[7] W. Little.
[8] F. W. Ricord.
[9] W. Earle Cass.
[10] C. V. Meyers.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec	Annual.
New Jersey—Continued.													
New Brunswick[1]	2.76	4.15	5.97	2.51	4.44	3.83	7.34	6.20	5.02	8.27	1.02	3.85	55.36
Newton	[2.30]	4.13	[6.00]	f2.65	7.17	3.03	5.01	5.38	4.52	6.71	0.61	[3.40]	[50.91]
Ocean City	[1.40]	5.10	4.80	3.60	3.70	[2.90]	3.60	3.50	5.11	3.40	0.70	4.00	[41.81]
Oceanic	2.42	4.52	5.87	2.94	4.27	3.76	7.25	6.77	7.59	10.18	0.48	5.74	61.79
Princeton	2.24	3.86	5.55	1.94	3.48	------	------	------	------	5.17	0.67	------	------
Rancocas	1.62	5.00	6.30	1.96	2.60	3.37	5.12	4.62	4.94	5.41	0.80	3.29	45.03
South Orange	2.91	5.32	6.71	2.43	4.62	5.06	5.74	4.43	4.33	6.98	0.78	4.08	53.39
Tenafly	2.85	4.46	7.92	2.63	4.54	5.16	5.74	4.23	3.63	8.49	0.76	3.38	53.79
Trenton	2.62	4.58	7.47	2.83	3.35	2.90	5.56	4.57	4.31	7.56	1.10	3.95	50.80
Union	2.50	4.51	5.17	2.23	3.78	4.17	------	------	------	------	------	------	------
Woodbury	1.90	3.85	5.32	2.26	2.87	g1.42	6.00	2.89	3.52	6.51	0.92	3.71	41.17
New Mexico:													
Albert (formerly Tequesquite)	------	------	------	------	0.43	1.22	3.23	3.06	0.29	0.43	0.28	0.74	------
Albuquerque	------	------	------	------	0.04	0.00	2.07	0.61	0.97	0.15	------	------	------
Antelope Springs	0.14	0.56	[0.90]	1.57	0.09	0.20	4.53	1.65	1.49	0.15	0.83	0.22	[12.33]
Bernalillo	------	1.00	1.30	------	------	------	1.10	1.20	1.50	0.50	0.60	2.00	------
Chama	2.25	2.90	1.64	1.66	0.27	0.55	2.61	2.05	1.91	2.77	1.50	0.50	20.61
Coolidge	------	0.40	------	------	------	0.80	0.30	0.59	------	1.00	0.00	2.60	------
Cuba	------	0.75	------	------	------	------	------	------	------	3.60	1.10	1.80	------
Deming	0.53	0.00	0.00	0.13	0.00	0.16	4.09	2.20	2.26	0.47	0.42	------	------
Embudo	0.28	0.18	0.78	2.39	0.05	0.43	1.88	0.04	0.60	0.40	1.66	2.90	11.59
Estalina Springs	1.24	0.15	0.25	0.40	0.05	0.24	3.36	1.86	2.36	0.32	1.61	0.80	12.64
Fort Bayard	1.40	T.	0.11	T.	0.00	T.	4.17	3.86	2.17	0.52	2.56	1.07	15.86
Fort Marcy	0.37	0.83	0.43	2.18	0.00	0.16	2.16	1.59	0.78	0.71	1.36	1.54	12.11
Fort Selden	0.73	0.00	0.02	0.04	0.00	0.29	0.84	2.63	1.34	[0.35]	[1.40]	[0.60]	[8.24]
Fort Stanton[2]	0.37	0.08	0.12	0.57	0.00	1.05	1.93	2.93	1.52	0.40	1.85	1.06	11.87
Fort Stanton[3]	0.35	0.30	0.01	0.50	0.10?	1.00	1.89	4.43	1.26	0.04?	1.85	1.58	13.31
Fort Union	T.	0.11	0.14	3.96	0.03	1.30	5.10	2.31	0.59	0.22	0.83	0.14	14.73
Fort Wingate	1.44	1.79	2.70	1.00	[0.00?]	0.10	2.03	2.29	2.94	0.95	1.20	1.43	[17.87]
Gallinas Springs	0.18	0.03	0.12	3.43	0.17	1.76	2.88	1.08	0.76	1.02	0.63	0.20	12.26
Hillsboro	1.64	0.04	T.	0.29	0.00	0.13	2.50	3.61	3.49	0.22	1.35	0.69	13.96

La Luz		T.	0.00	0.15						0.67	0.89		
Lordsburg	0.92	0.05	0.00	0.13	0.00	0.43	3.11	3.69	1.90	0.26	0.60	1.86	12.95
Lava	0.80	0.14	0.10	0.12	0.00	0.76	1.76	1.23	2.50	0.42	[1.60]	[0.70]	[10.13]
Los Lunas	0.05	0.87	1.36	0.63	T.	T.	1.00	T.	[0.90]	0.25	[0.80]	0.60	[6.46]
Magdalena	0.80	0.10	0.40	0.80		0.20	5.31						
Monero	1.52	2.07	1.86	1.27	0.00						1.75	2.48	
Nogal	1.98	1.80	0.24	0.89	[0.00]	0.88	5.09	4.16	1.80	0.76	[1.80]	0.77	[20.17]
Pojnaque	0.42	0.63	0.39	2.48	0.00	0.02	2.11	[1.40]	1.02	0.94	0.88	1.15	[11.44]
Red Cañon	1.18	T.	0.17	0.63	[0.00]	0.41	3.70	2.27	2.11	0.48	0.75	0.88	[12.58]
Roswell	0.33	0.15	0.00	0.76	0.03	0.48	2.17	4.89	0.76	[0.40]	[1.80]	[1.00]	[12.77]
San Marcial			0.00	0.00	0.00	0.00							
San Marcial (near)	0.87	0.20	0.05	0.30	0.27		0.95		1.53				
Santa Fé	0.42	0.88	0.69	2.08	T.	0.13	2.46	1.49	0.89	0.93	1.31	1.60	12.88
Springer	0.00	0.00	0.02	2.10	0.60	0.50	4.40	0.90	1.00	0.65	0.34	0.20	10.71
Taos	0.90	0.62	0.89	1.98	0.00	0.29	2.55	2.64	0.88	0.79	0.80	1.39	13.73
Tres Piedras	2.40	2.15	1.46	2.50									
Wallace	0.67		1.45	1.50			1.00						
New York:													
Adams' Center						2.38	4.02	7.28	7.28	4.88	2.72	2.03	
Addison							1.90	6.46	7.22	3.99	0.41	3.66	
Afton						2.86	2.37	6.66	4.19	6.22	1.68	3.81	
Akron						6.58	1.80	5.97	6.14	5.24	4.16	2.05	
Alabama					5.85	5.99	2.79	4.53	5.32	5.09	3.92	3.54	
Albany	2.28	2.52	3.72	1.64	5.19	2.72	2.37	5.66	8.91	5.76	1.18	2.94	44.89
Albion						4.96	3.20	4.25	4.34				
Alfred Center	3.50	2.31	3.01	3.56	6.95	3.42	1.63	6.17	9.47	4.79	1.60	2.72	49.13
Angelica	3.47	2.33	2.63	3.59	7.38	4.52	2.94	6.72	8.72	4.72	2.28	2.77	52.07
Arcade					8.33	5.23	3.52	3.86	7.94	5.98	3.59	1.64	
Ardenia	0.99	4.38	5.03	2.84	5.05	3.45	5.45	3.66	6.08	5.24	0.90	3.35	46.42
Au Sable Forks						2.88	2.43	5.19	3.69	2.60	2.48	3.40	
Avon						3.49	3.05	3.13	6.58	4.46	2.56	1.05	
Baldwinsville					5.75	5.64	1.90	3.89	8.72	6.30	4.34	3.01	
Batavi						3.37	3.95	4.06	5.98				
Bethlehem Center						2.60	2.62	5.48	7.97	5.86	1.67		
Binghamton						4.77	2.24	6.29	4.04	4.72	1.50	3.15	
Bloods Depot						4.18	2.56	5.95	7.47	5.28	2.47	2.90	
Boyds Corners	1.97	4.94	5.66	3.03	5.74	3.56	5.46	4.70	6.86	7.63	1.12	3.69	54.36
Brockport	[4.20]	3.06	3.43	2.70	6.65	3.59	2.49	2.99	4.99	4.99	3.98	1.88	[45.40]

[1] Mrs. G. H. Cook. [2] Signal Service. [3] U. S. post hospital.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
New York—Continued.													
Brookfield	4.95	3.56	4.11	3.26	7.84	4.72	1.97	6.94	6.36	6.01	3.31	5.60	58.63
Buffalo	3.90	3.66	2.46	3.48	6.13	5.23	1.27	3.52	4.71	6.12	3.91	2.16	46.55
Canton	4.46	4.19	1.68	2.14	4.76	3.33	3.80	4.19	4.94	2.28	4.06	1.94	41.77
Carmel	2.76	4.76	5.59	2.96	6.06	3.26	5.05	4.44	7.80	6.76	1.33	3.99	54.76
Central Park, N. Y. City	2.29	3.41	5.50	1.85	3.45	4.67	4.49	4.37	4.63	6.56	0.71	3.70	45.63
Chenango Forks						5.90	2.51		5.53		1.70	3.55	
Cherry Creek						3.46	4.83	4.64	6.21	8.72	4.87	3.92	
Chittenango						5.66		7.02	9.06	6.28	4.55		
Constableville	7.24	5.93	3.02	3.76	8.43	3.90	8.45	5.56	8.53	6.05	4.72	2.72	68.31
Cooperstown	4.39	2.91	4.17	2.86	8.84	4.89	3.39	6.01	7.24	5.91	3.17	4.33	58.11
Davids Island	2.72	2.49	5.90	2.19	3.91	5.63	3.96	4.14	4.56	6.66	0.69	3.84	46.69
De Kalb Junction						3.99	2.93	6.27	5.87	2.30	3.72	1.85	
Demster						2.48	3.84	2.82	9.47	4.80	4.00	2.83	
Deposit						4.65	3.13	9.09	2.88	5.79		2.45	
Dunkirk						2.86			5.93	7.71	3.66	1.26	
Easton								5.94	6.79	5.65	1.30	3.49	
Eden	8.67	2.70	4.85	5.22	9.23	4.63	1.97	5.94					
Elmira	1.84	1.68	2.48	3.91	6.04	4.67	2.52	5.75	6.14	3.84	0.86	2.54	42.27
Factoryville	2.25	2.18	3.33	2.65	5.62	4.78	3.07	5.80	8.24	5.24	0.97	4.34	48.47
Fleming	5.34	2.74	2.39	2.45	7.01	6.72	1.52	5.05	6.02	4.45	1.93	1.80	47.42
Fort Columbus	2.48	3.57	6.43	3.06	2.89	4.29	4.46	5.28	6.16	6.55	0.98	5.17	51.32
Fort Hamilton	2.67	3.19	6.31	1.72	3.16	2.98	4.98	4.60	3.38	6.00	0.60	5.25	44.84
Fort Niagara	3.15	2.56	1.56	2.34	3.60	4.59	0.87	4.34	4.03	4.21	2.79	0.58	34.62
Fort Porter	3.56	3.46	1.96	3.17	4.02	5.76	2.41	3.15	4.67	6.51	0.45	[2.20]	[41.32]
Fort Schuyler	2.85	3.84	7.23	2.64	3.93	4.32	4.32	3.49	4.14	6.75	0.88	4.62	49.01
Fort Wadsworth	3.43	4.28	6.67	2.77	3.26	4.18	6.17	5.20	4.52	7.83	0.92	4.69	53.92
Geneva	3.20	2.45	3.05	2.43	6.04	5.43	1.54	4.35	6.11	4.60	2.46	2.55	44.21
Hammondsport						3.36	1.77	4.90			1.54	2.20	
Hess Road Station	3.68	3.88	2.00	2.56	6.02	6.48	3.38	6.71	6.43	6.68	4.83	1.60	54.25
Honeymead Brook	2.11	2.74	4.30	1.75	4.64	3.46	5.17	7.41	5.89	6.45	0.79	3.38	48.09
Humphrey	5.02	3.91	3.34	4.95	9.11	3.76	3.43	5.31	9.00	5.94	3.81	1.91	59.49
Hyndsville							2.04	3.91	6.97	6.05			

Ilion	6.27	4.89	3.93	3.80	7.75	7.45	2.49	4.50	7.84	5.76	2.98	[4.30]	[61.96]
Ithaca	2.68	2.17	3.82	3.34	6.60	4.94	1.24	4.92	6.62	4.66	1.93	3.47	46.39
Keene Valley	4.42	3.73	1.49	1.82	4.96	2.34	2.22	6.99	4.58	3.08	3.02	2.59	41.24
Kendall	3.75	3.53	2.05	2.02	5.82	2.92	3.19	------	------	------	------	------	------
Kingston (Rondout)	2.10	3.76	5.77	1.62	6.51	1.96	1.84	9.46	4.26	5.28	0.67	4.00	47.23
Le Roy	[4.20]	3.45	3.91	[2.00]	[6.00]	2.77	3.23	3.32	5.40	4.12	3.08	5.22	[46.70]
Liberty	------	------	------	------	------	5.57	3.77	8.38	4.41	3.84	1.44	2.90	------
Lowville	------	------	------	------	------	3.68	4.30	3.82	9.70	4.26	4.79	2.80	------
Lyndonville	------	------	------	------	------	3.96	1.96	7.25	5.78	------	4.22	0.78	------
Lyons	2.92	2.76	0.94	2.25	4.48	3.77	4.41	3.41	9.61	4.66	2.81	3.64	45.66
Lyon Mountain	------	------	------	------	------	1.50	3.68	5.76	6.14	3.65	3.82	3.90	------
McLean	------	------	------	------	------	2.71	1.60	6.86	8.95	4.52	2.18	------	------
Madison Barracks	3.19	3.09	3.02	1.52	3.37	2.35	1.43	0.80	6.27	3.16	1.42	2.52	32.14
Malone	------	5.31	------	0.98	------	------	3.20	------	------	------	4.91	1.96	------
Marshland	2.86	2.77	3.43	2.76	7.83	3.99	1.60	4.57	4.83	4.51	1.28	2.70	43.13
Massena	------	------	------	------	5.07	------	------	------	2.41	2.25	------	1.30	------
Middleburg	2.50	2.15	4.31	1.50	4.15	3.20	2.25	2.85	5.35	5.50	3.00	3.15	39.91
Middletown	[0.90]	4.26	4.26	2.62	7.23	4.63	4.70	8.34	4.25	6.52	1.29	2.95	[51.95]
Mount Morris	------	------	------	------	5.20	4.74	1.43	2.49	6.43	3.46	2.07	------	------
Newark Valley	------	------	------	------	------	4.15	2.79	6.12	4.76	6.27	1.10	3.58	------
New Lisbon	[4.40]	[2.90]	3.86	2.90	9.18	3.31	2.16	4.80	6.32	6.18	2.16	2.93	[51.10]
New York City	2.95	3.86	6.67	2.58	3.11	4.19	3.96	4.06	8.21	6.46	0.82	5.43	52.30
North Hammond	3.27	4.38	1.81	1.78	3.59	3.12	2.78	3.63	3.66	[2.15]	2.85	1.75	[34.77]
Number Four	6.64	4.49	3.24	2.96	7.98	4.01	4.93	6.29	8.46	3.66	4.24	3.32	60.22
Oswego	4.46	3.25	1.85	2.16	4.61	2.43	3.18	2.19	6.33	4.64	4.13	3.61	40.86
Oxford	4.20	3.73	4.48	3.64	10.04	5.27	2.25	7.44	7.67	6.21	2.09	3.48	60.63
Palermo	4.11	2.62	1.49	2.00	4.75	2.60	3.68	1.95	7.55	4.19	3.95	1.63	42.37
Palmyra	------	------	------	------	------	4.83	2.32	3.85	8.18	4.81	3.25	2.79	------
Pawling	------	------	------	------	------	3.66	8.26	------	8.04	9.62	1.41	2.65	------
Peekskill	[0.90]	4.72	6.01	3.69	7.65	4.97	5.68	3.35	4.66	5.62	2.77	4.17	[54.19]
Pendleton Center	3.45	2.67	2.18	2.74	5.53	6.93	1.95	6.49	5.01	5.04	4.14	1.65	47.78
Perry City	3.24	2.35	4.05	3.71	6.95	4.55	1.67	6.97	6.98	6.02	2.56	4.02	53.07
Pine City	------	------	------	------	------	3.71	1.96	6.07	4.86	4.60	0.90	5.61	------
Plattsburg	[2.80]	2.11	1.32	1.72	5.00	3.40	3.61	6.05	2.88	2.76	2.07	1.93	[35.65]
Plattsburg Barracks	2.78	2.40	2.63	1.46	4.40	3.35	4.04	5.82	2.87	2.92	2.27	2.45	37.39
Port Jervis	2.06	4.00	5.68	2.68	7.25	4.47	6.22	5.88	4.82	7.25	1.21	3.53	55.05
Potsdam	2.75	6.42	4.40	1.88	5.08	4.27	3.39	4.33	4.41	2.33	3.76	2.00	45.02
Poughkeepsie	2.63	3.32	5.51	1.57	4.80	2.45	5.08	5.71	4.52	4.34	0.80	4.00	44.73
Quaker Street	2.48	2.46	4.28	1.50	5.91	2.21	2.29	3.46	8.11	7.01	2.76	4.44	46.91

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
New York—Continued.													
Queensbury	5.28	4.25	3.45	2.19	6.00	------	1.29	6.47	6.31	------	------	------	------
Rochester	4.83	3.59	2.99	2.17	6.00	2.66	1.62	2.31	5.13	4.77	4.05	2.97	43.09
Rome	5.68	4.77	4.00	4.03	7.00	6.59	3.21	5.70	8.59	7.26	5.96	4.03	66.82
Schodack	------	------	------	------	------	3.09	2.59	8.38	9.72	6.08	1.73	3.94	------
Setauket	1.87	3.00	6.56	3.40	3.50	2.97	5.25	4.27	6.53	10.20	0.74	5.65	53.94
Sherman	6.43	4.26	3.99	4.05	8.26	4.69	4.10	3.88	6.64	10.19	3.26	3.26	63.01
South Canisteo	3.89	2.67	4.33	4.22	8.64	5.03	2.31	7.41	12.72	6.51	1.90	4.00	63.63
Southeast Reservoir	2.73	4.55	6.01	3.72	5.92	3.63	5.08	3.91	7.80	6.35	1.09	4.41	55.20
South Kortright	2.95	2.06	3.22	1.86	5.24	4.66	2.31	5.11	5.64	4.80	1.81	5.25	44.91
Turin	7.15	4.83	3.30	1.82	5.69	4.09	7.47	5.40	7.32	5.47	4.99?	6.74	64..7
Utica	6.14	4.79	4.15	3.56	8.69	6.19	3.01	4.37	8.27	7.01	3.77	5.90	65.85
Wappingers Falls	------	------	------	------	------	2.46	7.01	5.96	4.27	5.79	1.19	4.57	------
Watervliet Arsenal	2.25	3.55	3.85	1.40	5.65	2.10	3.50	5.25	7.75	6.20	1.20	2.20	44.90
Wedgewood	2.67	2.52	4.09	2.74	7.04	3.52	1.02	5.48	8.53	5.45	1.58	3.84	48.48
West Point	1.96	5.12	5.91	3.90	5.07	4.60	7.00	4.10	6.80	4.30	1.00	1.02	50.78
White Plains	1.22	3.84	5.20	2.48	2.92	6.11	4.50	2.12	2.90	9.20	0.80	2.76	44.05
Willetts Point	2.56	3.92	4.32	5.60	3.38	5.30	5.86	4.38	5.43	6.50	1.11	3.44	51.80
North Carolina:													
Asheville[1]	1.38	5.49	1.89	3.19	4.29	1.87	5.13	7.00	3.87	[3.70]	[0.20]	[2.40]	[40.41]
Asheville[2]	1.42	5.30	2.50	3.93	4.44	1.13	5.86	6.71	3.86	3.77	0.29	2.44	41.65
Bryson City	2.97	8.37	4.55	5.03	5.54	1.51	7.04	6.09	5.04	5.09	0.24	4.25	55.72
Chapel Hill	2.23	3.63	3.80	1.86	4.81	3.66	[6.50]	[4.20]	4.83	5.69	T.	3.35	[44.56]
Charlotte	0.94	3.65	3.08	2.34	7.07	0.52	6.07	5.35	5.54	4.89	0.23	3.81	48.49
Clear Creek	0.60	3.95	3.00	1.80	1.85	1.80	6.15	6.15	6.35	4.55	[4.80]	[4.20]	[45.20]
Currituck Inlet	1.01	2.86	2.46	2.91	2.58	2.84	2.73	7.04	4.14	2.98	0.24	3.58	35.37
Douglas	1.60	5.50	3.40	3.00	5.70	1.20	11.65	4.75	3.25	[4.50]	0.40	2.20	[47.15]
Fayetteville	------	------	------	------	------	2.08	7.52	5.79	3.12	------	------	------	------
Franklin	1.00	6.60	3.40	2.20	3.00	2.00	5.30	------	5.20	3.70	0.00	2.50	------
Goldsboro	------	------	------	------	2.79	2.22	6.59	8.38	4.17	2.10	0.56	------	------
Hatteras	1.29	3.03	3.06	4.28	4.78	4.04	5.95	8.51	9.63	4.93	T.	6.01	55.51
Highlands	4.13	9.23	7.82	[4.20]	7.03	3.20	14.48	9.01	8.42	3.03	1.91	5.20	[77.66]
Kitty Hawk	[1.20]	f3.14	1.77	2.90	3.80	1.46	4.38	8.57	3.99	3.71	0.07	3.34	[38.33]

Lenoir	1.10	5.70	3.30	[2.40	4.70	2.80	7.20	9.80	7.20	4.40	0.00	2.60	52.20
Lumberton					8.00	6.80	6.62	6.99	4.67	3.80	1.11		
Marion						e2.64	8.26	4.83	3.52	6.03	0.70	2.18	
Morganton	[1.20]	6.43	[3.00]	2.00	4.80	3.85	6.55	4.76	5.02	4.96	0.40	1.88	[44.85]
Mount Airy	1.49	5.33	4.74	1.91	6.32	1.72	8.75	6.81	6.79	4.33	0.17	4.17	52.53
Mount Holly	1.12	3.58	2.64	2.74	5.72	0.73	[6.00]	3.67	5.27	5.52	0.00	4.57	[41.56]
Mount Pleasant	1.29	3.97	3.01	2.52	4.53	3.19	7.38	8.39	[6.00]	5.40	0.30	4.89	[50.87]
Murphy	4.26	10.48	4.89	4.61	5.40	3.77	7.71	6.25	6.98	6.32	0.84	5.86	67.37
New Berne	0.67	2.16	2.82	2.75	5.50	5.09	9.70	3.69	6.77	3.51	0.20	[4.00]	[46.86]
Oak Ridge	1.06	4.70	1.93	3.07	4.44	[1.45]	[6.50]	l2.10	6.29	4.68	T.	3.45	[39.67]
Pittsboro	0.62	2.50	2.41	1.68	5.55	3.25	5.65	4.20	4.00	4.60	0.20	3.55	38.21
Raleigh[3]	0.83	2.80	3.74	1.96	4.16	2.37	11.23	5.83	3.11	3.91	0.06	3.57	43.57
Raleigh[4]	0.50	2.20	3.41	1.45	3.48	2.01	11.30	4.85	1.75	3.85	[0.06]	3.25	[38.11]
Salisbury	1.06	3.23	2.75	2.16	4.64	1.94	6.06	8.87	7.74	5.58	0.13	4.74	48.90
Smithfield						e0.30	10.05	5.40	2.45	4.10	0.20	3.60	
Soapstone Mount	1.80	4.25	[2.30]	[1.90]	6.50	3.62	6.50	4.25	6.25	6.25	0.25	6.75	[50.62]
Southport	0.89	1.76	1.53	1.86	4.75	2.23	12.05	3.52	8.36	2.66	0.13	1.34	41.08
Wadesboro					4.52	f2.62	7.26	5.92	4.39	4.00	0.45		
Washington	7.40	2.31	4.07	4.31	3.10	6.99	7.66	9.62	2.91	7.61	0.15	4.11	60.24
Weldon	1.02	3.03	5.07	2.15	5.98	4.15	6.92	6.95	3.39	4.97	0.05	4.95	48.63
Willeyton	0.50	1.58	1.90	3.10	2.85	4.50	7.66	10.72	5.05	3.55	0.25	5.25	46.91
Wilmington	1.59	1.25	1.50	2.73	5.26	3.26	8.22	6.48	8.19	1.88	0.36	0.61	41.33
Winslow	1.00	2.00	2.30	1.40	6.20								
North Dakota:													
Bismarck	0.80	0.27	0.49	0.68	0.57	8.40	1.14	0.69	0.98	1.37	0.14	0.22	15.75
Davenport	0.43	0.30	0.38	0.10	1.47	5.75	3.04	3.25	2.73	2.20	[0.20]	[0.09]	[19.94]
Fort Abraham Lincoln	0.10	0.10	0.30	0.85	0.89	10.93	1.48	0.86	0.85	1.40	0.07	0.28	18.11
Fort Buford[3]	0.22	0.18	0.58	0.60	1.58	5.23	1.06	0.22	2.05	2.45	0.03	0.04	14.24
Fort Buford[5]	0.22	0.18	0.58	0.60	1.58	5.23	1.06	0.22	2.04	2.45	0.03	0.04	14.23
Fort Pembina	0.54	0.24	[0.90]	1.41	1.07	5.84	2.75	2.39	3.89	3.98	0.29	0.15	[23.45]
Fort Totten	0.35	0.60	0.27	1.97	0.79	5.70	1.25	2.37	0.80	4.00	0.00	[0.00]	[18.10]
Fort Yates[3]	0.31	0.35	0.30	1.23	0.49	6.45	2.54	1.71	0.76	0.61	0.26	0.70	15.71
Fort Yates[5]	0.28	0.43	0.22	1.33	0.57	6.84	2.59	1.51	0.68	0.60	0.16	0.39	15.60
Gallatin	0.09	0.26	0.21	0.46	1.06	3.51	2.63	2.53	1.89	2.00	0.09	0.06	14.85
Grand Forks				0.34	1.21	3.77	1.48			3.59	0.12	0.13	
Kelso							2.51	2.06	1.49	2.60	0.20	0.09	
Napoleon	0.59	0.43	0.10	0.52	[0.50]	7.19	0.46	1.06	1.02	1.44	0.20	0.36	[13.87]
New England City	0.55	0.18	0.03	1.56	2.35	6.93	1.96	0.04	0.55	1.25	0.18	0.50	16.08

[1] Signal Service rainfall station. [2] Dr. Karl von Ruck. [3] Signal Service. [4] T. C. Harris. [5] U. S. post surgeon.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
North Dakota—Continued.													
Steele	0.65	0.50	1.35	0.80	1.35	7.93	0.59	0.45	0.34	[1.40]	0.10	0.30	[15.76]
Wahpeton	0.50	[0.50]	0.30	0.72	2.98	5.75	4.84	2.91	3.32	1.73	0.35	0.10	[24.00]
Wild Rice						7.07	1.41	3.39	2.09	1.84	0.35	0.20	
Ohio:													
Akron	3.99	4.99	4.03	3.21	7.33	4.02	2.16	4.83	6.56	6.23	3.26	2.48	53.09
Ashland	4.42	5.50	3.89	2.99	7.42	3.93	1.45	5.44	4.53	5.49	2.19	1.82	49.07
Athens	4.59	5.37	6.38	2.71	5.29	2.91	[h]2.92	5.60	6.46	3.84	2.58	3.37	52.02
Bangorville	5.74	6.05	5.11	2.93	7.00	5.12	2.01	3.52	5.29	4.20	3.52	1.92	52.41
Bellevue	3.11	4.43	4.30	6.30	7.10	5.47	0.98	3.84	2.53	4.95	2.21	1.35	46.57
Bement	3.23	3.70	3.47	2.98	6.64	3.13	2.77	4.23	3.93	6.26	2.69	1.72	44.75
Bucyrus				3.25	8.11	5.27	4.07	5.97					
Caledonia	5.12	5.67	4.40	2.08	6.48	4.92	2.66	4.55	7.48	4.43	3.42	1.38	52.59
Canton	3.94	6.17	3.73	3.87	7.99	2.21	2.15	6.16	5.38	6.58	2.43	1.91	52.52
Carrollton	4.95	6.30	5.95	5.70	8.70	5.10	3.30	3.70					
Celina	5.26	4.76	3.56	3.98	5.07	3.60	0.40	4.25	4.89	2.37	2.62	0.91	41.67
Cincinnati	5.28	4.63	6.26	2.63	3.58	6.00	1.46	5.91	3.28	4.14	2.65	1.88	47.70
Circleville[1]	4.76	5.14	4.19	3.82	4.03	4.07	0.97	6.72	3.02	3.40	1.84	1.68	43.64
Circleville[2]	5.11	5.26	6.30	3.02	4.35	5.02	1.46	7.41	3.29	3.08	2.00	[1.68]	[47.98]
Clarksville	6.49	4.31	6.57	3.11	5.49	4.83	1.43	4.36	1.91	3.38	2.91	2.13	46.92
Cleveland[3]	4.03	4.58	3.93	2.49	6.16	4.50	2.77	3.14	5.58	5.85	3.04	1.75	47.82
Cleveland[4]	3.36	4.19	3.82	2.89	6.39	5.22	3.29	2.69	5.52	6.74	3.14	1.74	48.99
College Hill	7.90	4.64	7.67	3.00	3.50	3.80	0.20						
Columbus	5.73	6.12	5.63	4.32	5.12	4.95	1.80	2.75	7.13	3.02	1.97	2.19	50.73
Columbus Barracks	5.64	5.79	4.69	3.18	5.25	5.68	2.50	3.38	7.88	3.12	2.23	1.91	51.25
Dayton	4.83	5.09	4.34	2.70	3.54	3.28	0.28	5.27	7.37	2.42	2.27	1.18	42.56
Demos	5.93	6.48	7.42	4.28	6.24	5.62	1.91	6.40	8.83	7.25	2.53	3.91	66.80
Ellsworth	[4.00]	[5.00]	[4.00]	4.00	8.11	6.00	1.95	3.88	6.34	5.37	2.72	2.54	[53.91]
Elyria	4.07	4.22	4.14	4.21	7.72	4.03	3.38	3.91	4.02	5.85	3.46	2.05	51.06
Findlay	4.22	4.76	3.94	4.60	6.40	3.80	[c]0.63	2.70	2.67	4.20	2.72	2.11	42.75
Fostoria	3.00	4.92	4.22	2.35	4.57	5.34	0.90	3.20	[2.70]	2.45	[2.70]	[1.00]	[37.35]
Garrettsville	4.51	4.99	3.48	3.96	7.87	3.73	2.23	3.92	4.33	7.36	3.19	3.31	52.88
Georgetown	6.52	7.08	7.25	2.94	3.39	6.38	2.18	8.39	2.17	4.60	3.14	2.86	56.90

Granville	4.62	6.36			3.36		2.03	4.48	7.33				
Gratiot	5.12	5.51	5.61	3.18	5.65	7.97	2.81	5.80	7.28	3.82	2.27	2.76	57.84
Greenville	5.78	4.71	3.99	3.37	4.66	4.66	0.07	4.60	4.52	1.45	2.50	1.01	41.32
Hanging Rock	3.86	7.22	8.40	3.87	4.93	5.42	4.38	7.44	4.12	3.74	2.46	4.38	60.22
Hassan	2.40	5.10	6.00	4.80	6.45	[3.50]	0.72	1.00	3.00	3.90	2.90	3.15	[42.92]
Hiram	4.43	4.68	3.76	3.22	7.43	4.41	1.68	3.69	4.67	7.74	3.27	2.35	51.33
Hudson	4.47	5.10	[4.30]	3.14	7.68	2.89	2.06	1.93	5.31	7.38	3.34	2.69	[50.29]
Jacksonboro	5.40	5.00	5.65	1.95	4.35	5.60	0.30	3.35	3.40	1.80	2.20	1.50	40.50
Jefferson	4.42	4.26	5.02	3.79	6.90	3.29	2.37	6.28	[5.10]	8.29	2.94	1.14	[53.80]
Kent	4.59	4.47	4.45	3.05	5.55								
Kenton	4.74	4.63	4.68	3.85	5.27	6.84	1.03	3.87	6.59	5.34	2.61	1.14	50.59
Leipsic	[4.20]	3.43	4.49	4.46	5.92	3.16	1.67	2.74	2.80	3.47	4.11	1.65	[42.10]
Logan	5.69	5.47	6.61	2.99	6.85	3.74	1.80	7.62	8.44	3.90	2.31	3.19	58.61
Lordstown	3.73	4.40	3.81	3.05	7.84	2.87	2.87	3.94	5.94	6.36	2.31	2.52	51.64
McConnellsville	5.44	5.08	5.33	2.53	[5.90]	8.23	2.61	7.95	6.55	3.74	3.08	3.68	[60.12]
Mansfield	5.00	6.03	4.87	3.83	6.38	4.73	1.75	6.04	3.61	5.68	3.56	1.54	53.02
Marietta[1]	4.74	5.32	6.20	3.37	4.71	5.97	2.63	7.07	[8.80]	4.27	2.97	5.10	[61.15]
Marietta[5]	4.96	4.96	6.62	3.29	5.20	5.31	3.16	5.24	8.87	5.14	2.56	5.68	60.99
Marion						3.15	1.03	3.84	6.25	4.87	2.80		
Napoleon	5.37	3.31	2.55	6.85	5.77	5.95	0.13	4.08	3.74	4.12	2.54	1.11	45.52
New Alexandria	5.04	5.82	5.47	4.51	4.63	3.67	3.22	5.48	7.01	6.00	1.83	5.85	58.53
New Comerstown	5.50	6.00	5.39	3.43	5.09	8.72	5.24	5.76	8.89	4.53	1.53	2.71	62.79
North Lewisburg	5.20	5.95	4.90	2.55	4.70	1.85	0.30	3.05	8.20	3.45	3.25	1.85	45.25
Oberlin	3.51	4.46	4.14	3.73	5.90	3.26	4.32	2.88	3.78	5.34	2.86	1.73	45.91
Ohio State University	5.50	5.93	4.84	3.99	4.69	5.43	1.37	3.71	8.16	2.71	1.76	2.28	50.47
Orangeville	4.30	4.20	2.60	3.15	7.70	2.85	1.80	3.90	5.05	5.50	2.55	2.75	46.35
Ottawa	4.24	3.70	4.45	5.07	5.67		0.76	2.19	2.95				
Pomeroy	3.30	5.16	6.47	4.79	6.52	2.03	[1.40]	6.36	4.11	2.47	1.04	2.34	[45.99]
Portsmouth[6]	5.61	7.04	8.42	3.53	4.32	4.14	3.07	6.10	4.52	[3.80]	3.22	[3.60]	[57.37]
Portsmouth[7]	5.62	7.02	8.42	3.54	4.33	4.23	2.98	6.36	4.40	3.87	3.22	3.60	57.59
Salineville	4.73	6.24	3.26	4.18									
Sandusky	3.49	3.10	2.78	3.68	5.28	2.78	1.99	3.17	4.15	4.66	2.56	0.96	38.60
Shiloh	2.50	4.75	3.15	3.15	5.65	2.75	1.25	3.95	6.00	6.15	2.74	0.80	42.80
Sidney	4.89	4.98	4.74	3.22								1.41	
Springboro	6.15	5.21	6.04	2.63	5.60	3.92	1.33	4.11	4.32	3.08	1.70	1.73	45.82
Tiffin	3.73	4.25	4.30	4.81	6.58	6.96	0.90	2.32	2.54	5.80	2.35	1.03	45.57
Toledo	3.39	2.90	1.56	4.05	4.04	2.49	0.86	4.43	2.68	3.93	2.27	1.04	33.64

[1] Signal Service river stations.
[2] H. Renick.
[3] Signal Service.
[4] G. A. Hyde.
[5] Prof. T. D. Briscoe.
[6] Signal Service rainfall station.
[7] Dr. D. B. Cotton.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Ohio—Continued:													
Upper Sandusky	3.90	4.96	3.89	3.58	7.19	5.94	2.44	4.15	5.58	3.43	1.86	1.11	48.03
Vienna	2.60	4.15	3.56	3.78	7.24	1.75	2.68	3.84	6.46	6.89	2.45	3.19	48.59
Wapakoneta	3.77	5.11	9.58	1.68	5.49	1.04	0.70	4.46	4.31	1.60	[2.10]	[0.90]	[41.24]
Wauseon	4.14	3.43	3.45	5.29	4.78	3.88	0.48	3.48	3.19	3.76	2.25	1.16	39.29
Waverly	4.76	3.91	6.70	2.59	4.92	5.93	3.00	5.66	6.04	4.31	2.34	3.42	53.58
Waynesville	6.47	5.26	5.95	2.65	4.71	4.50	0.48	4.07	5.13	3.05	2.45	1.98	46.70
Westerville	6.31	5.32	4.51	2.78	5.73	3.46	2.99	3.76	8.17	2.64	2.11	1.92	49.70
West Milton	8.23	6.48	4.73	2.60	4.25	4.64	0.72	4.42	10.20	2.80	3.30	2.07	54.44
Weymouth	3.92	4.93	4.60	4.13	6.14	3.85	2.03	5.52	5.31	5.77	3.49	2.90	52.59
Wheeler									4.20	7.74	3.66	1.86	
Wooster	4.71	6.20	4.37	3.10	6.37	4.92	2.67	4.66	5.13	7.45	2.62	1.74	53.94
Yellow Springs	6.17	6.04	5.35	2.82	4.52	3.26	[0.28]	[5.30]	4.55	2.32	2.85	[1.20]	[44.66]
Youngstown	4.11	4.89	4.38	3.52	5.44	2.83	2.59	4.29	7.53	5.62	2.71	3.02	50.93
Zanesville	4.97	5.09	5.47	3.19	5.03	7.51	4.59	6.13	8.20	3.38	1.99	1.89	57.44
Oklahoma:													
Fort Reno	2.04	0.31	0.31	6.02	2.87	0.76	1.87	3.21	3.98	4.96	2.32	0.14	28.79
Fort Sill	1.73	0.46	0.31	8.77	4.58	0.22	0.44	3.00	2.17	4.7.	4.06	0.63	31.08
Guthrie	2.18	0.31	0.62	5.37	1.38	1.09	0.74	5.73	4.35	4.20	2.82	1.23	30.02
Oregon:													
Albany	10.63	11.18	6.86	1.77	0.39	1.41	0.38	0.28	0.05	1.74	0.44	4.89	40.02
Alpine				0.03	0.52	1.20	0.11	0.02	0.53				
Ashland[1]	3.07	3.58	3.37	0.60	1.90	0.55	0.00	0.82	1.50	0.75	0.05	2.85	19.04
Ashland[2]	3.66	5.42	3.00	0.78	1.91	0.60	0.37	0.79	1.37	0.33	0.05	1.98	20.26
Astoria	12.64	11.48	7.56	2.62	1.14	3.23	1.84	1.56	0.13	5.61	1.87	8.81	58.49
Baker City	1.55	2.08	1.99	0.36	1.33	0.07	0.01	0.12	1.22	1.02	T.	0.75	12.50
Bandon	20.75	13.85	11.65	1.91	0.23	1.08	0.12	0.03	0.00	1.51	0.33	7.32	58.78
Beulah	2.93	2.08	2.12	0.37	0.52	0.35	T.	0.07	0.33	T.	0.00	0.92	9.71
Burns			0.15		0.40	0.00						0.03	
Cascade Locks	14.42	22.28	7.10	2.81	0.75	6.54	0.48	0.39	0.02	6.86	1.74	7.57	70.96
Corvallis	10.62	8.88	5.67	1.82	0.29	1.23	0.50	0.14	T.	1.65	0.22	3.80	34.82
Creswell	14.51	9.75	6.72	2.02									
East Portland	6.34	6.50	1.83	0.34	0.32	2.08	0.13	0.06	T.	1.86	0.11	1.31	20.88

Ellensburg (Gold Beach)	*31.84*	23.68	14.44	2.98	1.01	2.69	0.32	0.00	0.11	1.66	0 10	4.67	83.50
Eola	7.63	9.48	4.26	1.00	0.26	1.18	0.05	0.01	0.00	2.30	1.42	4.33	31.92
Forest Grove	12.88	7.85	4.84	1.67	0.31	1.34	[0.50]	[0.10]	0.00	2.07	0.70	4.81	[37.07]
Gardiner	21.86	14.33	10.12	2.67	0.88	2.86	0.78	0.04	0.00	2.74	0.36	6.64	63.28
Grants Pass	13.88	10.12	4.68	1.23	0.35	2.10	T.	0.13	1.22	0.46	0.12	2.96	37.25
Grass Valley	1.62	4.95	1.11	0.34	------	------	------	------	------	------	------	------	------
Happy Valley (Diamond)	------	------	------	1.38	0.52	1.75	0.00	0.26	0.54	0.09	------	------	------
Heppner	1.13	1.38	2.75	0.39	0.71	2.26	0.02	0.17	0.85	1.20	0.11	1.42	12.39
Hood River	6.98	8.10	3.14	0.93	0.19	0.47	0.16	0.08	0.00	2.43	0.06	3.09	25.63
Hubbard	10.21	7.96	6.14	[1.60]	[2.50]	o1.57	0.90	0.22	0.00	2.94	0.50	4.35	[38.89]
Jacksonville	8.46	8.03	3.25	0.82	1.62	0.38	0.00	0.50	1.79	0.17	0.18	2.52	27.72
Jordan Valley	2.01	1.78	3.14	0.37	2.88	0.49	------	------	------	------	------	------	------
Joseph	1.41	4.96	1.75	1.95	1.62	3.21	0.33	0.00	0.07	1.97	0.44	1.17	18.88
La Grande	2.20	2.83	2.29	0.41	3.24	2.64	0.17	0.27	0.19	1.17	0.23	0.90	16.54
Lakeview	------	------	------	------	------	0.23	0.00	T.	2.29	0.12	T.	1.00	------
Lone Rock	1.31	2.64	3.05	0.49	0.48	1.97	0.14	0.00	1.24	0.97	0.12	1.14	13.55
McMinnville	14.21	8.70	6.19	1.92	0.64	1.87	0.57	0.23	0.10	2.32	0.44	4.66	41.85
Mount Angel	8.41	7.65	6.25	1.36	0.59	2.10	0.61	0.00	0.00	2.42	0.51	3.72	33.62
North Powder	2.05	2.04	0.66	0.11	1.94	1.51	0.03	0.22	[1.20]	0.23	T.	[0.70]	[10.69]
Parker	1.17	0.48	4.94	2.13	3.16	1.18	0.19	0.02	------	4.84	------	------	------
Pendleton	1.19	1.52	2.04	0.17	1 51	1.80	0.08	0.07	0.27	0.63	T.	1.46	10.74
Portland	11.13	9.85	6.23	1.41	1.08	2.23	0.59	0.13	0.10	2.79	0.50	4.34	40.38
Roseburg	12.23	9.24	4.68	0.98	1.11	1.47	0.01	0.10	0.53	1.11	0.19	3.00	34.65
Saint Helens	13.47	7.84	4.40	1.60	------	------	------	------	------	------	------	------	------
Silver Lake	1.03	2.74	1.04	0.34	------	------	------	------	------	------	------	T.	------
Siskiyou	12.80	14.40	5.75	0.53	1.20	0.36	0.00	0.00	0.30	0.00	0.00	1.38	36.72
Telocaset	2.22	2.21	1.90	0.44	2.44	2.83	0.38	0.37	0.58	0.56	0.00	0.70	14.63
The Dalles	2.97	4.33	1.89	0.14	0.02	0.27	0.06	0.04	0.11	1.16	0.00	1.19	12.18
Tillamook	19.55	14.10	9.10	------	------	------	0.00	1.50	------	1.80	------	------	------
Tillamook Rock L. H.	------	------	------	------	------	------	1.73	1.20	0.00	3.89	------	8.43	------
Toledo	20.60	10.35	7.10	2.87	0.85	3.15	------	0.04	0.00	6.26	0.71	2.65	------
Vernonia	15.27	10.04	5.38	2.78	1.00	2.60	0.58	0.33	0.09	3.76	0.63	8.59	51.05
Weston	------	3.26	2.98	0.35	0.24	------	------	0.23	------	------	------	------	------
Pennsylvania:													
Allegheny Arsenal	4.21	5.66	4.01	4.94	5.10	3.86	2.85	4.71	4.96	6.32	1.42	4.98	53.02
Altoona	2.17	4.09	2.90	5.29	4.47	2.52	3.22	4.09	4.25	4.12	1.07	3.80	41.99
Aqueduct	2.26	4.37	5.57	3.98	10.38	4.02	1.89	6.87	3.83	5.00	0.32	2.25	50.74
Bethlehem	2.29	4.67	6.12	2.57	[6.90]	3.10	[5.00]	5.31	3.51	6.17	0.82	[3.00]	[49.46]

[1]Pacific Railway System.

[2]F. L. Carter.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Pennsylvania—Continued.													
Blooming Grove	2.20	4.50	8.50	3.10	8.30	4.80	6.20	9.10	4.40	8.30	0.60	4.10	64.10
Blue Knob	2.09	3.66	5.04	5.50	6.50	4.50	1.60	6.00	0.65	1.73	0.78	8.63	46.68
Brookville	2.56	2.30	2.19	2.90	7.32	2.26	2.08	4.70	5.47	6.63	2.58	3.30	44.29
Brower's Lock	------	------	------	------	------	------	------	------	2.54	5.34	0.96	2.37	------
Cannonsburg	5.01	5.55	4.48	4.24	5.20	1.82	3.93	6.89	[7.00]	[7.40]	1.91	[4.90]	[58.33]
Carlisle	2.16	4.12	5.87	3.19	5.47	2.90	1.91	9.65	4.12	5.72	0.81	4.20	50.12
Catawissa	2.06	3.41	[5.60]	2.92	7.41	2.72	2.68	5.44	2.81	5.99	1.17	4.10	------
Center Valley	2.45	3.34	5.04	3.17	------	------	------	------	------	------	------	------	------
Chambersburg	1.80	3.90	------	1.55	5.55	------	------	------	------	5.48	1.21	------	------
Charlesville	1.52	2.81	5.46	2.74	5.65	1.87	1.53	a2.58	4.05	5.42	1.57	3.83	39.03
Clarion[1]	5.72	4.90	4.36	4.78	9.57	2.36	2.51	7.38	6.87	6.81	3.18	4.68	63.12
Clarion[2]	6.87	4.78	3.98	------	7.20	------	------	------	------	c5.19	1.77	------	------
Coatesville	2.67	4.88	7.29	2.39	7.85	3.07	3.77	4.77	3.36	6.34	1.07	3.51	50.97
Confluence	4.63	5.23	6.94	4.75	6.12	3.38	2.88	5.75	5.84	8.06	2.55	4.06	60.19
Coopersburg	2.88	5.32	7.92	3.21	7.93	3.14	5.53	6.72	4.18	6.04	0.95	3.76	57.58
Corry	5.07	4.65	4.33	4.65	9.15	5.66	3.95	6.20	7.10	7.25	4.29	3.36	65.66
Doylestown	1.55	4.29	5.09	2.51	5.41	5.59	4.65	5.41	3.28	6.26	1.09	3.38	48.51
Drifton	1.94	3.60	4.81	3.25	8.07	3.64	5.92	5.30	3.55	5.50	[1.40]	[2.40]	[49.39]
Dyberry	2.74	3.74	5.00	2.53	5.56	4.24	4.45	6.35	4.40	7.39	1.68	5.29	53.37
Eagles Mere	5.57	6.20	7.61	4.23	8.97	3.72	4.24	7.28	7.11	8.41	1.64	7.02	71.00
Easton	1.99	3.75	6.39	3.42	5.98	4.72	5.79	6.00	3.22	5.65	1.26	3.38	51.55
Emporium	3.80	5.02	4.79	3.98	9.61	4.85	4.87	7.76	7.91	5.30	2.16	3.21	63.26
Erie	4.50	3.60	3.43	3.16	6.40	4.23	0.76	4.64	5.16	6.13	3.32	1.72	47.05
Forks of Neshaminy	2.40	4.28	5.66	2.91	5.00	5.74	4.41	5.90	3.05	5.75	b0.95	2.51	48.56
Frankford Arsenal	1.45	3.10	4.45	2.20	2.95	2.60	4.60	2.70	1.70	5.38	1.05	1.70	33.88
Franklin	4.50	4.84	4.78	4.07	9.98	2.96	4.19	4.99	6.60	[6.90]	[3.30]	[5.30]	[62.41]
Frederick	2.68	4.35	6.43	2.36	6.87	2.78	5.39	7.04	3.35	5.36	1.16	2.44	50.21
Freeport	4.89	5.46	4.95	5.76	6.15	3.95	3.32	4.50	5.05	6.48	2.14	5.28	57.93
Germantown	2.18	2.97	[5.10]	2.15	6.50	2.27	5.12	3.93	2.64	4.58	1.13	2.41	[40.98]
Gettysburg	2.25	4.51	4.66	3.31	8.10	3.91	2.78	8.95	2.51	[5.50]	[1.00]	[2.20]	[49.68]
Girardville	2.94	4.56	5.25	4.40	12.41	4.56	6.36	6.48	4.51	6.24	1.67	4.65	64.03
Grampian Hills	4.41	5.52	5.29	3.39	6.77	2.74	3.24	6.41	5.87	6.36	1.73	4.28	56.01

Greensboro	*5.10*	*5.25*	*5.19*	*3.75*	*9.23*	*5.38*	4.05	6.05	8.03	8.05	2.14	2.93	65.15
Greenville	4.58	5.05	5.12	4.57	[5.60]	3.44	2.52	4.28	6.19	6.85	2.92	2.68	[53.80]
Hamburg									3.94	5.26	0.87	2.21	
Harrisburg	2.01	3.39	3.80	2.46	6.61	2.97	2.86	5.70	2.89	6.40	1.12	2.42	42.63
Hollidaysburg	3.04	4.76	4.18	4.96	5.82	4.30	2.37	3.87	5.18	5.02	1.48	5.71	50.69
Honesdale	2.29	3.19	4.48	2.87	6.11	4.14	4.73	5.97	4.55	6.77	1.18	4.01	50.29
Huntingdon	3.00	5.18	3.61	4.91	6.36	4.18	4.56	4.40	3.55	5.04	*d*1.38	3.35	49.52
Indiana		5.89	4.67	4.66			2.05		8.10	5.31	2.14	6.51	
Johnstown	4.95	5.05	5.74	4.66	6.90	2.72	1.87	6.38	5.85	5.21	2.38	4.89	56.60
Kennett Square	2.37	4.74	4.76	2.73	6.89	2.59	5.17	7.40	5.02	5.49	0.83	3.37	51.36
Lancaster	2.03	3.14	4.84	2.93	7.04	2.20	[3.80]	[4.80]	1.24	7.34	1.04	*m*1.08	[41.48]
Lansdale	2.29	4.28	5.33	2.12	5.18	2.19	4.30	4.57	2.67	6.52	1.17	2.37	42.99
Leroy	2.01	2.96	4.58	3.26	7.00	4.37	2.51	5.71	5.45	5.32	0.89	5.78	49.84
Lewisburg	1.92	3.89	3.21	3.54	6.40	2.80	3.79	5.78	3.70	5.74	1.21	2.99	44.97
Lewistown	2.49	4.16		3.66	6.88	3.76	2.47	5.27					
Ligonier	[5.00]	[5.00]	[5.70]	3.38	6.79	1.94	2.47	9.37	8.54	5.50	2.13	3.69	[59.51]
Lock Haven	3.14	4.04	5.48	4.22	7.30	3.61	2.85	*a*3.83	3.87	5.36	1.35	4.43	49.48
Lock No. 4	5.57	5.04	5.62	3.25	7.80	2.89	4.65	7.39	6.12	6.82	1.77	5.83	62.75
Lynnport	2.30	5.00	5.30	1.75	5.00	4.40	6.40	6.50	5.20	[5.50]	[1.20]	[3.40]	[51.95]
McConnellsburg	2.09	4.00	5.41	3.38	7.90	4.87	3.12	6.60	2.62	6.92	1.59	3.30	51.80
Mahoning	4.03	3.08	3.72	2.83	5.63	1.76	0.59	3.58	4.52	5.54	1.59	1.60	38.47
Mauch Chunk	2.86	5.36	6.07	3.45	8.11	5.25	5.79	8.59	4.64	[a]4.03	1.00	3.18	58.33
Meadville	[4.50]	[4.50]	4.81	4.43	7.04	1.92	2.76	3.94	5.82	4.75	2.81	3.10	[50.38]
Meshoppen	1.06			1.23						2.30	1.01		
Myerstown	2.59	3.78	6.46	3.39	6.79	2.80	3.36	5.12	5.15	5.52	1.23	3.98	50.17
New Bloomfield	1.47	6.11	5.87	3.47									
New Castle	4.54	6.39	4.29	3.82	7.25	2.65	1.55	3.69	7.48	6.26	2.48	2.13	52.53
Nisbet	3.50	3.70	4.30	4.00	6.20	3.60	3.80	4.30	3.90	6.40	1.30	4.25	49.25
Oil City	1.60	2.46	2.75	1.32	8.50	4.91	2.24	5.56	7.31	3.97	2.58	1.96	45.16
Ottsville	2.70	4.61	5.69	2.41	7.29	5.12	6.90	5.37	2.99	5.82	1.07	2.37	52.34
Parkers Landing	4.96	5.33	4.24	4.55	8.44	2.08	1.96	5.92	6.68	7.04	2.18	3.91	57.29
Petersburg	2.65	4.98	3.73	4.11	6.96	3.27	3.03	4.58	2.35	5.59	1.38	3.91	46.54
Philadelphia[3]	1.83	3.39	4.61	2.28	2.96	1.30	4.03	3.36	2.31	4.82	0.80	2.33	34.02
Philadelphia[4]							4.28	3.46	2.23		0.92	3.21	
Philipsburg	2.65	5.14	3.83	3.97	7.02	2.73	0.74	4.33	5.19	5.31	*f*1.27	4.17	46.35
Phœnixville									3.09	5.12	1.22	2.67	
Pittsburg	4.18	5.52	3.86	4.87	5.85	3.37	2.22	4.06	4.24	5.66	1.14	5.64	50.61
Pleasant Mount	4.70	4.20	4.88	2.70	6.10	5.20	4.85	[6.00]	4.60	6.95	1.79	[4.10]	[55.98]

[1] Signal Service river station. [2] C. M. Thomas. [3] Signal Service. [4] Wm. R. Wallen.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Pennsylvania—Continued.													
Point Pleasant	2.44	4.73	6.37	1.84	5.57	3.58	5.38	6.01	2.44	5.76	0.95	3.20	48.27
Pottstown	2.35	4.81	8.05	1.97	7.61	2.11	5.45	3.80	4.01	6.10	1.00	2.86	50.12
Quakertown	3.19	5.18	8.31	3.22	6.55	3.13	5.50	5.86	4.82	7.25	1.24	3.21	57.46
Reading	3.18	4.15	4.88	2.62	----	----	----	----	3.98	5.31	0.88	2.47	----
Salem Corners	3.21	3.80	6.82	2.98	6.93	4.87	5.17	7.15	3.46	6.80	1.26	5.45	57.90
Saltsburg	4.98	6.97	5.54	4.50	5.48	2.96	2.03	5.07	6.08	6.89	1.87	5.91	58.28
Seisholtzville	2.94	4.39	6.69	3.23	5.99	2.61	5.01	6.37	4.07	5.60	1.08	2.98	50.96
Selins Grove	1.02	[4.00]	[3.80]	4.11	3.56	1.36	3.58	5.81	3.13	6.97	1.54	4.38	[43.26]
Smiths Corners	2.93	4.38	6.71	2.46	5.29	3.89	5.46	5.75	2.68	5.99	0.98	2.66	49.18
Somerset	5.60	4.51	5.42	3.16	8.90	4.93	2.36	7.90	7.84	7.12	3.00	5.52	66.26
South Eaton	1.60	3.09	4.46	1.81	7.47	2.81	2.72	7.53	2.05	5.18	0.78	3.31	42.81
State College	2.78	4.31	3.85	3.75	6.77	2.34	2.44	5.46	2.29	5.24	1.46	3.19	43.88
Swarthmore	1.87	3.93	5.20	2.88	5.59	[5.70]	3.67	d4.38	2.62	6.16	0.88	2.49	[45.37]
Tipton	3.51	[5.00]	3.90	5.14	5.03	1.86	0.50	0.80	3.67	5.72	1.57	[3.80]	[40.50]
Troy	1.07	1.91	2.71	2.25	5.68	3.53	1.69	9.57	4.08	5.37	0.70	5.00	43.56
Tuscarora (Kilmer)	2.02	4.49	3.88	3.59	5.60	2.84	2.78	7.24	4.55	6.09	1.22	3.06	47.36
Uniontown	6.10	4.73	6.27	3.90	8.03	4.33	5.65	8.44	6.73	7.41	2.25	6.84	70.68
Warren	4.34	3.68	3.66	5.09	8.19	4.71	2.24	5.97	8.70	6.62	2.82	2.20	58.22
Waynesburg	3.72	5.10	4.65	2.90	4.90	3.85	2.50	5.45	5.90	[7.40]	[1.40]	[4.60]	[52.37]
Wellsboro	1.98	2.28	6.03	4.03	7.80	5.14	2.65	6.89	4.39	4.69	0.93	4.97	51.78
West Chester	2.60	5.41	6.77	3.15	6.42	2.42	6.27	5.87	4.07	6.28	1.23	3.94	54.43
Westtown	n0.37	2.39	4.68	[2.90]	5.90	2.83	[4.60]	[5.40]	3.60	5.75	0.97	3.30	[42.69]
Wilkes Barre	1.97	3.00	4.89	2.62	6.84	5.07	5.78	5.44	2.42	4.85	1.29	3.95	48.12
Wysox	1.99	2.46	3.38	d3.42	[7.00]	4.75	3.62	5.71	4.37	4.24	0.81	3.48	[45.23]
York	1.84	2.85	5.44	1.94	6.65	3.29	1.77	5.65	4.55	6.60	0.80	3.29	44.67
Rhode Island:													
Block Island	2.33	1.50	5.16	3.37	3.83	1.35	1.39	2.09	2.69	4.57	0.66	2.57	31.51
Bristol	2.43	2.51	8.14	3.54	5.48	5.17	1.66	3.87	4.00	8.20	0.85	4.95	50.80
Fort Adams	1.68	2.41	4.26	3.58	3.86	4.84	1.48	1.76	5.48	3.91	1.20	3.61	38.07
Kingston[1]	3.02	3.30	9.83	4.72	4.70	3.98	1.88	3.89	3.93	9.43	0.96	5.51	55.15
Kingston[2]	2.99	3.54	8.45	4.28	5.33	4.00	2.33	4.01	5.48	10.04	0.96	6.16	57.57
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5.01	10.55	0.68	5.25	52.60

Narragansett Pier	*3.13*	*3.22*	*8.41*	*4.53*	*5.30*	*3.42*	*2.85*	*4.73*	*4.65*	*9.07*	*0.81*	*5.09*	*55.21*
Pawtucket	3.01	3.33	5.23	3.81	6.45	2.84	1.25	3.16	4.98	9.18	0.74	5.06	49.04
Providence[3]	2.79	3.35	8.27	3.59	4.48	2.68	1.81	2.61	4.82	9.19	0.74	5.28	49.61
Providence[4]	2.93	3.72	7.12	3.60	4.48	2.45	1.16	2.39	4.24	8.86	0.78	4.33	46.06
South Carolina:													
Aiken	1.08	1.85	5.10	-------	-------	-------	-------	-------	-------	-------	0.50	1.01	
Allendale	-------	-------	-------	-------	4.57	2.65	7.46	3.24	8.62	3.38	0.91		-------
Batesburg	-------	-------	-------	-------	4.01	4.27	9.16	4.10	4.50	4.75	0.25	-------	-------
Belmont	1.57	2.35	2.78	2.23	6.33	2.12	5.76	4.71	8.82	6.15	0.22	2.09	45.13
Blackville	-------	-------	-------	-------	7.86	1.66	7.71	1.98	8.71	4.29	0.80	-------	-------
Branchville	-------	-------	-------	-------	4.42	2.33	6.36	4.31	5.08	0.99	0.76	-------	-------
Brewer Mine	1.36	1.78	-------	-------	-------	-------	4.89	5.50	8.12	4.44	1.35	3.93	-------
Charleston	1.28	1.28	1.72	2.58	3.67	1.32	12.87	5.16	11.89	4.64	0.42	1.01	47.84
Cheraw	1.27	1.30	3.64	2.09	4.13	0.93	5.61	6.06	3.85	3.20	0.65	1.96	34.69
Chester	-------	-------	-------	-------	3.52	0.72	3.37	1.99	5.04	4.42	0.12	-------	-------
Columbia[5]	1.07	1.58	2.80	2.19	4.17	1.13	9.34	3.93	7.09	4.35	1.47	1.57	40.69
Conway	0.96	0.85	2.19	1.21	3.59	1.43	5.13	[4.70]	[8.00]	1.91	0.18	1.07	[31.22]
Evergreen	[1.10]	4.64	3.41	[2.60]	9.08	3.29	5.32	3.31	7.18	7.19	0.11	3.95	[51.18]
Florence	0.93	1.92	2.86	2.70	4.86	3.24	6.08	5.12	8.21	4.12	1.56	[1.90]	[43.50]
Greenville	1.91	5.35	5.60	2.60	8.03	2.32	5.25	6.15	3.89	6.91	0.05	4.15	52.21
Greenwood	1.10	1.88	2.80	[2.60]	6.71	0.78	5.78	3.39	7.27	6.17	0.00	[2.00]	[40.48]
Hardeeville	0.33	1.05	2.40	1.60	4.51	3.90	6.67	4.47	11.03	4.13	0.46	[2.90]	[43.45]
Jacksonboro	0.70	1.01	3.21	1.74	2.53	3.37	9.64	1.68	10.04	2.64	0.62	1.09	38.27
Kingstree	-------	-------	-------	-------	7.14	1.89	6.19	4.68	7.50	1.14	T.	-------	-------
Kirkwood	0.86	2.29	3.32	1.74	4.19	2.27	6.32	3.95	6.12	3.40	1.05	2.02	37.53
McCormick	-------	-------	-------	-------	6.12	2.37	8.93	1.85	4.13	5.73	0.29	1.99	-------
Port Royal	0.28	0.96	2.55	2.44	2.66	2.31	9.21	1.61	13.68	3.65	0.19	2.05	41.59
St. George	-------	-------	-------	-------	6.17	2.34	7.52	2.65	12.03	2.89	0.89	-------	-------
St. Matthew	-------	-------	-------	-------	8.60	3.78	4.42	2.17	7.21	1.39	1.23	-------	-------
Simpsonville	[1.00]	5.69	4.33	1.54	11.61	5.71	6.65	3.31	2.32	5.71	0.12	3.11	[51.10]
Spartanburg[6]	1.16	5.00	3.69	2.60	8.39	2.26	5.01	5.39	5.55	6.53	0.04	3.39	49.01
Spartanburg[7]	1.10	5.12	3.79	1.82	9.88	3.05	3.75	6.06	5.07	7.37	0.04	1.20	48.25
Statesburg	0.90	1.65	3.53	2.73	6.13	2.65	8.34	7.07	3.50	3.35	0.90	1.81	42.56
Timmonsville	-------	-------	-------	2.40	5.20	0.95	6.85	-------	6.00	-------	-------	-------	-------
Trial	1.18	1.51	2.53	1.76	8.05	3.19	6.16	5.83	7.71	5.25	0.57	1.31	45.05
Walhalla	2.75	[5.00]	2.98	3.45	7.55	3.37	5.68	4.42	9.50	[3.00]	0.55	2.85	[51.10]

[1] C. O. Flagg.
[2] Nathaniel Helme.
[3] City engineer's office.
[4] D. W. Hoyt.
[5] Signal Service.
[6] J. F. Bayerly.
[7] Cotton Belt.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
South Carolina—Continued.													
Winnsboro	1.30	3.24	1.35	1.10	3.60	[2.00]	7.26	7.95	9.29	6.34	1.84	[2.00]	[47.27]
Yorkville	1.66	4.34	3.79	1.87	5.78	2.76	8.38	2.65	6.15	6.34	0.26	3.35	47.33
South Dakota:													
Aberdeen	[2.00]	[0.45]	0.18	0.28	2.04	7.54	g1.40	0.85	1.18	1.33	0.40	0.20	[17.85]
Alexandria	0.55	[0.19]	1.10	1.54	3.80	4.26	2.38	2.86	2.16	1.00	0.50	0.20	[20.54]
Brookings	0.65	[0.15]	0.56	0.79	3.33	7.91	1.54	2.07	0.45	0.31	0.30	0.80	[18.86]
Canton	1.65	0.10	2.30	2.12	3.64	3.91	1.68	2.46	0.87	0.73	1.36	0.60	21.42
Clark	T	T	[1.00]	0.45	3.10	6.28	1.49	0.88	0.87	0.96	0.22	[2.30]	[17.55]
Cross (Etta Mine)			1.84	1.41	2.28	2.56		f1.29	c0.03		m0.08		
De Smet	0.45	0.50	0.41	1.14	3.19	5.35	1.25	1.25	0.70	0.32	0.70	0.60	15.86
Flandreau	0.25	0.15	0.42	1.08	4.85	5.98	3.25	2.06	0.92	0.65	0.53	0.39	20.53
Fort Bennett	0.05	1.30	0.14	0.76	1.53	4.41	1.40	0.71	2.03	0.43	0.59	0.24	13.59
Fort Meade	0.55	0.46	1.24	1.65	2.31	6.30	0.16	1.64	0.76	0.38	0.40	0.38	16.23
Fort Randall	0.60	0.12	1.19	2.35	2.06	2.37	1.95	1.94	0.13	0.64	0.64	0.05	14.04
Fort Sully[1]	0.15	0.20	0.28	0.58	1.27	6.41	0.25	0.61	1.54	0.54	1.01	0.44	13.28
Fort Sully[2]	0.14	0.20	0.39	0.58	1.27	6.29	0.26	0.63	1.40	0.51	0.80	0.32	12.79
Highmore	[0.50]	[0.00]	0.30	0.19	0.83	6.17	0.36	0.56	0.45	0.32	0.30	[0.30]	[10.28]
Howard									0.34	0.64	0.45	0.75	
Huron	0.66	0.18	0.32	0.64	2.88	5.87	1.41	0.73	0.32	0.61	0.38	0.68	14.68
Kimball	0.60	0.18	0.87	1.45	2.03	3.07	1.98	2.21	0.17	0.44	0.68	0.40	14.08
Milbank	0.00	[0.60]	[1.00]	0.27	1.54	10.53	0.86	1.53	1.45	1.35	0.30	0.45	[19.88]
Oelrichs	[0.40]	[0.60]	1.12	1.47	2.59	[3.70]	1.07	0.10	0.13	0.09	0.45	0.10	[11.82]
Onida				0.10	0.22		0.24	0.27	1.25	0.25	0.55		
Parkston	1.00	0.20	1.47	1.73	2.10	3.20	2.30					0.15	
Rapid City	0.47	0.66	1.40	1.55	2.46	3.77	0.13	1.83	0.75	0.56	0.27	0.17	14.02
St. Lawrence								0.74	0.26	0.46	0.41	0.35	
Scranton	0.35	0.60	0.43	0.54	0.66	9.74	1.72	0.23	1.15	0.72	0.58	0.87	17.59
Sioux Falls						3.70	1.35	3.03	3.78	0.37	0.35	0.75	
Spearfish	2.10	0.75	1.54	1.47	3.42	6.81	0.20	1.66	0.53	1.37	0.35	0.53	20.73
Vermillion	0.67	0.55	0.82	1.13	2.37	2.19	2.89	2.14	0.35	1.35	0.58	0.10	15.14
Webster	2.04	0.53	1.67	0.28	3.58	9.31	3.73	3.39	2.07	1.88	3.20	2.28	33.96
Woolsey	0.50	0.08	0.29	0.40	1.81	4.98	1.16	0.88	0.43	0.51	0.58	0.65	12.97

Woonsocket	0.80	0.15	0.71	0.87	2.42	4.47	1.04	0.81	0.34	0.52	0.47	0.70	13.30
Yankton	0.56	0.46	1.07	1.84	4.18	3.59	4.27	2.16	1.16	0.92	0.79	0.25	21.25
Tennessee:													
Andersonville	3.21	7.92	6.25	3.68	5.69	2.95	4.35	5.11	5.01	3.41	0.90	4.75	53.23
Arlington	9.20	11.20	7.90	3.74	4.65	4.95	6.22	9.72	9.46	3.69	3.75	[3.70]	[78.18]
Ashwood	7.89	10.34	7.81	3.52	3.18	2.51	1.51	3.33	4.42	3.71	1.08	3.72	53.02
Austin	8.65	9.13	9.56	4.39	5.97	4.68	0.26	4.70	6.69	4.94	1.57	3.03	63.57
Bolivar[3]	10.70	-------	-------	-------	-------	m1.27	m3.20	l4.00	-------	1.90	0.30	-------	-------
Bolivar[4]	-------	-------	-------	-------	5.74	3.70	4.95	12.35	9.76	1.99	0.30	-------	-------
Brownsville	-------	-------	-------	-------	3.87	4.76	2.47	7.35	6.01	2.73	3.58	-------	-------
Carthage	7.62	9.28	7.66	5.68	4.05	4.04	1.27	7.18	5.46	3.64	1.68	6.08	63.64
Charleston	4.55	9.20	5.03	4.15	5.54	5.12	6.99	5.45	5.25	5.23	0.37	4.88	61.76
Chattanooga	4.68	7.85	4.78	3.94	3.95	3.12	4.43	5.15	7.10	4.13	0.16	3.13	52.42
Clarksville	6.75	9.35	10.29	3.58	4.57	3.25	1.43	8.43	3.43	2.98	2.45	3.46	59.97
Clinton	4.67	9.83	6.35	3.79	6.71	4.35	3.65	3.31	5.57	4.38	0.30	5.74	58.65
Cog Hill	6.60	6.40	2.40	3.00	2.30	1.90	2.80	-------	1.40	-------	-------	-------	-------
Columbia	7.32	11.01	7.79	4.05	4.01	2.11	4.43	3.44	5.93	3.99	0.80	3.47	58.35
Covington[5]	8.58	10.72	6.31	7.47	5.51	6.98	3.33	4.33	6.71	3.04	6.49	4.15	73.62
Covington[4]	-------	-------	-------	-------	4.87	4.94	2.56	3.86	5.52	2.91	5.78	-------	-------
Cumberland Gap	4.09	9.98	7.14	5.54	6.04	5.34	4.63	5.01	5.84	4.29	1.11	6.04	65.05
Dare	-------	-------	-------	-------	-------	-------	5.20	4.50	-------	5.80	0.00	-------	-------
Dunlap	3.87	8.89	4.36	-------	-------	8.36	-------	-------	-------	-------	-------	-------	-------
Dyersburg[4]	-------	-------	5.28	5.04	3.96	2.06	2.13	3.84	5.54	-------	-------	-------	-------
Dyersburg[6]	7.07	8.05	8.38	3.94	3.89	2.41	2.13	5.68	5.14	2.68	4.47	[4.60]	[58.44]
Fayetteville	5.79	7.56	5.20	3.34	4.04	3.96	2.74	4.17	2.92	3.24	0.09	2.11	45.16
Florence Station	3.35	10.96	7.48	3.37	4.25	4.49	1.32	6.28	7.18	3.59	1.14	4.09	57.50
Franklin	-------	-------	-------	-------	-------	-------	-------	-------	5.15	3.44	1.87	4.32	-------
Grand Junction	9.00	8.90	7.36	[3.70]	6.79	2.90	6.43	4.76	9.72	3.68	3.72	[3.90]	[70.86]
Greeneville	2.90	7.18	5.69	3.56	5.80	4.03	7.02	7.03	3.78	4.23	0.15	3.71	55.08
Grief	3.69	9.44	5.27	1.94	5.29	2.30	-------	4.50	-------	-------	-------	-------	-------
Hohenwald	8.89	11.43	8.87	4.03	4.82	3.07	1.54	5.09	7.75	3.31	2.05	4.50	65.35
Jacksboro	3.27	9.07	6.47	4.09	7.23	3.37	6.93	5.18	4.46	4.25	0.66	4.53	59.51
Johnsonville	8.36	5.85	4.15	3.51	2.52	1.31	0.06	6.18	6.97	1.97	2.33	6.30	49.51
Kingston	5.95	11.09	6.03	4.17	4.73	0.69	4.24	4.10	8.70	5.48	T.	4.54	59.72
Kinston Springs	7.70	9.39	9.40	4.11	4.23	[2.20]	1.00	5.65	8.75	[3.00]	2.75	[4.00]	[62.18]
Knoxville	4.26	8.12	5.72	4.10	4.34	2.89	3.42	4.39	3.83	3.69	0.17	4.66	49.59
Lawrenceburg	5.98	15.75	7.82	3.02	3.30	2.74	-------	-------	-------	-------	-------	-------	-------
Lewisburg	5.11	8.42	7.86	4.03	3.95	4.16	3.20	3.20	5.51	2.78	0.90	3.90	53.02

[1] Signal Service. [2] U. S. post surgeon. [3] H. C. Calahan. [4] Cotton Belt. [5] Jas. I. Hale. [6] Fred Hughes.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Tennessee—Continued.													
Loundon	4.31	9.41	6.03	3.60]	4.48	1.06	2.65	4.85	6.99	4.50	0.25	4.10	[52.23]
Lynnville	7.76	7.45	6.94	[2.73	3.70	3.91	4.03	4.33	4.18	[3.70]	[1.10]	4.56	[54.39]
McKenzie	5.00	8.30	9.25	4.47	4.38	2.13	1.00	[5.20]	6.90	2.70	4.58	[5.00]	[58.91]
Memphis	8.43	8.13	7.93	5.10	4.42	3.55	2.82	7.56	9.07	2.75	4.88	3.64	68.28]
Milan[1]	9.11	8.14	8.41	5.34	3.99								
Milan[2]					3.72	4.79	0.76	8.48	6.02	2.64	4.09		
Nashville	8.10	10.95	8.64	3.84	4.16	2.23	0.46	6.59	5.86	3.01	2.01	4.12	59.97
Nunnelly	7.34	7.34	7.90	4.58	4.26	3.97	0.03	4.62	4.22	2.82	2.24	3.11	52.43
Parksville	4.26	8.32	5.88	3.90	6.24	4.16	4.01	5.03	4.54	4.20	0.00	3.11	53.65
Riddleton	7.94	9.87	7.65	5.02	5.49	4.28	3.92	7.36	5.08	3.39	1.66	5.46	67.12
Rockwood	5.95	10.35	4.63	3.40	4.58	1.04	3.57	2.76	7.68	4.27	0.33	4.47	53.03
Rogersville	2.91	7.17	5.90	4.15	4.59	2.28	3.80	4.03	3.30	3.30	0.22	5.38	47.03
Rugby	4.78	11.75	6.87	5.23	6.32	2.40	2.99	6.82	8.23	3.72	0.74	4.03	63.88
Savannah	8.20		9.30	4.14	4.06	4.54			8.50	2.34		5.31	
Sharps	[6.00]	9.94	7.85	4.25	3.40	3.63	2.60	8.31	5.34	[3.40]	1.53	3.68	[59.93]
Springdale	3.15	7.07	7.63	4.34	6.63	2.22	5.09	9.91	2.23	4.01	0.33	5.72	58.83
Strawberry Plains	4.10	7.31	5.49	4.18	4.62	2.87	3.80	2.91	3.57	1.22	0.02	4.35	44.44
Trenton	7.70	8.50	8.31	4.48	3.11	4.85	0.50	8.58	4.90	2.48	5.49	5.09	63.99
Union City								5.28	3.42	2.70	5.74	4.45	
Watkins	7.64	10.28	8.68	3.37	4.17	1.65	1.40	7.45	6.86	3.01	[4.50]	[5.10]	[64.11]
Waynesboro	6.20	9.00	7.87	5.10	3.48	3.60	1.14	3.15	6.85	2.48	0.47	2.50	51.84
Woodstock	5.70	6.75	4.15	3.25	4.90	2.70	1.35						
Texas:													
Abilene	0.33	1.81	0.14	9.80	2.69	0.65	2.10	2.11	5.19	0.97	2.10	0.61	28.50
Austin	2.44	4.54	0.58	5.49	6.88	4.70	1.75	0.34	4.48	3.12	1.25	0.85	36.42
Bear Creek													
Belton					2.16	2.11	0.16	0.42	0.14	2.10	0.07		
Berlin									3.75	2.48	3.92	3.32	
Brady	0.42	1.91	0.61	5.97	2.68	2.05	0.74	6.63	3.48	1.31	2.23	1.70	29.73
Brazoria	5.58	4.08	3.21	7.64	5.25	7.24	7.67	4.21	5.20	5.64	1.80	1.38	58.90
Brenham	[4.40]	3.45	3.41	7.67	3.53	5.54	0.67	3.05	5.23	3.18	1.83	1.84	[43.90]
Brownsville	0.69	1.23	0.14	5.48	3.33	2.32	3.97	1.51	1.51	3.67	1.32	0.38	25.55

Brownwood	0.59	2.19	0.61	8.61	3.18	1.38	1.28	1.53	2.69	1.58	2.91	2.70	29.25
Burnet	------	------	------	------	2.22	4.35	0.17	2.55	1.16	2.70	2.47	1.32	------
Caddo Peak	0.25	2.30	0.44	8.05	14.28	------	------	------	------	------	------	------	------
Camp del Rio	------	------	0.00	2.70	j0.75	------	T.	1.85	7.20	------	0.00	0.73	------
Camp Eagle Pass	0.28	0.22	0.08	4.45	2.65	6.15	0.83	0.60	3.96	0.27	1.15	0.45	21.03
Camp Pena Colorado	T.	[0.00]	0.20	0.70	3.05	2.23	2.30	3.61	3.48	2.54	0.48	0.70	[19.29]
Childress	------	0.28	T.	6.78	1.23	0.44	0.53	4.33	1.01	1.73	T.	T.	------
Cold Water	------	------	------	------	------	------	------	2.32	0.08	g0.24	0.37	1.16	------
College Station	6.94	3.28	3.93	5.55	4.33	4.95	0:45	0.75	4.92	2.62	0.99	1.73	40.44
Colorado	0.14	[1.80]	0.30	10.21	1.35	1.32	1.75	4.02	5.87	1.05	1.02	[0.00]	[28.83]
Columbia	7.90	5.45	3.88	5.80	8.33	7.22	3.07	4.01	10.01	5.93	3.96	0.55	66.11
Corpus Christi	3.84	2.01	1.67	1.36	2.40	3.22	0.99	1.81	1.07	2.47	0.37	1.80	23.01
Corsicana[3]	2.20	[4.60]	2.82	9.79	9.11	2.07	1.00	0.82	2.44	5.09	2.80	[0.80]	[43.54]
Corsicana[2]	[2.20]	4.67	k1.50	9.79	6.25	1.80	0.85	1.68	3.01	6.40	2.19	0.89	[41.23]
Cuero	------	------	------	------	i2.22	5.99	0.07	0.72	·9.89	4.84	0.18	------	------
Dallas[4]	2.25	2.35	1.75	7.25	1.15	0.30	1.50	------	------	------	------	------	------
Dallas[3]	2.89	3.70	3.14	[7.20]	3.75	1.28	1.82	0.69	2.92	5.92	2.79	[1.70]	[37.80]
Decatur	0.81	1.95	2.14	9.02	------	------	------	------	------	------	------	------	------
Durham	------	------	------	------	------	1.25	0.53	2.59	3.21	0.55	1.10	0.00	------
Dural	1.67	3.55	0.15	5.85	3.55	3.60	0.30	2.05	3.40	[3.80]	1.85	0.60	[30.37]
Edinburg	0.90	0.00	0.14	2.12	2.32	2.68	3.41	0.17	0.00	4.02	0.15	0.18	16.09
El Paso	0.72	0.02	0.01	0.06	T.	0.63	0.95	3.25	1.81	0.41	0.35	0.28	8.49
Epworth	1.17	0.62	0.00	5.37	0.95	2.37	2.32	2.25	0.34	1.36	2.20	0.00	18.95
Forestburg	1.32	1.87	4.40	11.12	1.30	1.20	0.20	2.44	5.01	4.93	4.80	2.15	40.74
Fort Bliss	0.81	0.10	0.00	0.06	0.00	0.23	1.53	4.50	2.19	0.46	0.42	0.25	10.55
Fort Brown	0.91	1.15	0.00	3.80	2.27	2.50	3.40	1.30	1.50	4.23	1.82	0.30	[23.18]
Fort Clark	0.16	0.55	0.00	2.75	1.75	2.35	2.32	1.72	5.70	0.92	1.44	2.00	21.66
Fort Davis	T.	T.	0.00	1.20	0.93	3.64	4.93	2.65	2.60	0.86	0.31	1.22	[18.34]
Fort Elliott[5]	2.40	0.01	0.02	3.94	1.69	1.71	0.88	2.89	0.05	[0.00]	[0.50]	[0.20]	[14.29]
Fort Elliott[6]	2.38	0.02	0.02	3.81	1.62	1.56	0.89	2.69	------	------	------	------	------
Fort Hancock	0.78	0.00	0.00	0.00	0.13	0.34	0.38	1.95	0.23	0.82	0.16	0.10	4.89
Fort McIntosh	0.90	0.05	0.20	3.06	5.80	2.48	2.09	0.10	0.33	0.18	0.35	0.20	15.74
Fort Ringold	0.78	0.94	0.50	1.25	2.41	1.73	0.13	0.38	0.00	3.77	0.35	0.19	13.43
Fort Worth	1.16	1.04	2.60	------	------	------	0.56	2.89	5.59	3.93	------	------	------
Fredericksburg	1.24	3.58	0.41	4.00	3.42	3.30	0.20	3.30	4.59	4.13	1.85	1.82	31.84]
Gainesville	0.94	4.25	2.52	13.60	2.57	1.13	1.00	3.24	------	------	------	------	------
Gallinas	0.73	3.17	0.84	4.76	4.17	3.59	3.46	2.29	2.34	1.42	1.18	0.98	28.93

[1] Dr. M. D. L. Jordan. [2] Cotton belt. [3] W. H Hamilton. [4] Chas. F. Mercer. [5] Signal Service. [6] U. S. post surgeon.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Texas—Continued.													
Galveston	2.86	1.92	4.96	5.14	5.38	7.42	1.82	5.09	4.79	4.38	2.37	1.67	47.80
Graham	0.46	1.41	0.54	10.16	3.78	0.05	0.14	1.17	3.44	3.66	3.30	1.26	29.37
Grapevine						j0.50	0.72	1.37	6.87	7.32	5.25	2.50	
Hartley	0.50			3.10		1.50	2.55	4.28	0.10	0.50	0.30		
Haskell				8.45	3.41	0.00	0.62	1.77					
Hearne	2.00	3.35	1.88	7.87	4.75	2.00	0.70	0.81	3.30	6.42	2.04	[1.70]	[36.82]
Houston	5.48	3.60	3.94	10.59	4.41	5.79	2.04	5.75	3.50	7.36	3.50	1.55	57.51
Howe	1.80	3.06	3.92	10.34	3.87	1.56	4.70	1.93					
Huntsville	10.46	3.92	4.38	8.32	2.86	3.24	3.02	4.85	3.11	3.62	3.52	[1.70]	[53.00]
La Grange	5.60	2.62	2.75	6.20	4.43	4.06	1.67	3.78	10.02	4.23	0.00	1.73	47.09
Lampasas	1.29	3.31	0.55	5.40	4.49	3.03	0.20	2.23	1.89	2.59	2.26	0.83	28.07
Longview	5.59	12.85	4.67	8.00	5.43	3.04	2.42	0.41	3.87	6.50	3.79	4.35	60.92
Luling				5.20	4.74	3.75	0.01	2.04	2.21	1.40	0.95		
Menardville	[0.30]	1.47	0.00	4.17	1.18	2.86	0.32	4.21	3.47	1.27	1.74	2.36	[23.35]
Merkel	0.30	0.80	1.81	6.29	3.05	0.53	3.37	2.15	[5.00]	[0.90]	2.94	[0.89]	[28.03]
Mesquite	0.39	3.71	1.60	8.65	4.80	0.83	2.13	4.18	4.85	5.75	3.82	0.89	42.60
Miami	0.22	0.00	0.02	0.57	0.11	0.23	1.85	0.26	0.00				
Mountain Spring	[1.50]	[1.90]	3.30	11.22	1.38	[1.20]	0.50	1.42	6.35	6.28	5.08	2.14	[41.27]
New Braunfels	0.70	2.40	1.01	8.41	3.82	[4.10]	0.84	1.58	6.47	2.58	0.63	1.24	[33.78]
New Ulm	4.21	3.08	2.07	6.37	4.07	4.87	1.17	3.86	6.26	3.11	1.20	1.27	41.55
Ochiltree			T.	3.25	2.16	1.33	0.12	3.19	0.58				
Orange					2.87		9.98	6.29	5.61	4.84	1.90		
Palestine	5.76	4.95	4.94	6.96	6.85	3.18	1.76	2.05	3.42	9.01	1.91	1.27	52.06
Panhandle	1.36	2.04	0.00	4.52	1.26	1.70	3.29	0.92	0.00	[0.00]	0.52	0.20	[13.81]
Panter	0.70	1.32	1.38	9.25	3.07	1.36	0.47	2.02	2.72	2.83	3.47	1.71	30.30
Paris					2.05	1.36	1.90	2.56	2.39	4.13	3.03		
Pike			°0.60	12.15	3.68	0.71							
Rio Grande City	1.58	0.57	0.23	1.30	2.36	2.08	1.29	0.54	0.39	5.48	0.51	0.14	16.47
Round Rock	[1.70]	1.90	0.70	4.60	1.26	2.92	0.42	1.16	3.23	3.80	2.35	1.70	[25.74]
San Antonio[1]	1.87	2.92	0.98	5.22	2.39	4.16	0.88	1.44	5.41	1.92	1.02	1.58	29.79
San Antonio[2]	1.74	2.90	1.05	2.93	2.39	2.24	0.31	[1.40]	5.41	1.83	1.00	1.58	[24.78]
Santa Maria		0.00	0.00	2.62	0.56	3.18	2.28	0.35				0.17	

Silver Falls	0.79	0.50	0.40	4.34	2.75	3.84	2.46	1.07	0.34	1.96	1.34	T.	19.79
Tyler	j0.00	1.30	0.00	4.20	0.03	2.19	2.25	1.60	4.28	5.90	2.32	[4.40]	[28.47]
Venus	-----	-----	-----	-----	-----	-----	-----	1.51	2.51	2.68	3.13	0.69	-----
Waco	2.25	4.80	2.40	9.85	7.90	2.50	3.10	1.00	2.20	3.60	1.95	0.30	41.85
Weatherford	-----	-----	-----	-----	2.07	0.73	0.56	0.40	4.30	2.67	5.27	j2.68	-----
Utah:													
Alta	0.50	12.00	0.00	0.00	-----	-----	-----	-----	-----	0.00	0.00	2.40	-----
Beaver	1.03	0.67	0.53	0.60	0.12	T.	0.51	0.44	1.22	0.17	0.27	0.50	6.06
Bingham	0.29	2.20	0.40	0.00	0.00	-----	-----	-----	-----	0.00	0.00	0.46	-----
Blue Creek	2.00	0.85	1.80	1.20	0.95	0.40	0.34	0.80	T.	0.75	0.00	0.55	9.64
Corinne	4.00	1.55	1.70	1.15	1.10	0.00	0.05	0.20	0.10	0.60	0.00	0.90	11.35
Fort Douglas	3.07	2.05	1.12	0.94	0.16	0.43	0.05	1.83	0.04	1.39	0.00	0.16	11.24
Fort Du Chesne [1]	1.02	0.44	0.00	0.41	0.00	0.00	0.86	0.67	0.48	1.36	0.33	0.38	5.95
Fort Du Chesne [2]	1.01	0.27	0.02	0.21	0.00	0.00	1.35	0.85	0.32	1.17	0.03	0.27	5.50
Grouse Creek	-----	-----	-----	-----	-----	0.48	0.05	1.12	0.10	0.36	T.	0.48	-----
Kelton	2.50	0.65	0.80	0.95	0.65	0.15	0.00	0.10	0.20	0.38	0.00	0.35	6.73
Lake Park	2.85	1.12	2.14	0.67	1.09	0.66	0.00?	0.66	0.15	1.69	0.00?	1.38	12.41
Levan	2.20	1.15	1.45	0.25	0.48	0.10	0.40	0.45	0.28	1.05	[0.00]	[1.50]	[9.31]
Losee	1.10	2.40	0.55	0.40	0.40	0.00	3.30	1.20	1.50	0.90	1.15	0.80	13.70
Moab	0.58	1.28	0.68	0.29	T.	T.	0.10	0.61	0.26	0.18	1.05	0.55	5.58
Mount Carmel	2.25	1.94	1.33	0.73	0.27	T.	0.27	0.94	1.30	0.30	0.27	2.71	12.31
Mount Pleasant	1.49	3.46	2.30	0.00	0.53	0.26	0.90	0.52	0.05	0.88	0.41	1.57	12.37
Nephi	1.54	0.63	0.83	0.67	0.67	0.17	0.55	0.42	0.45	1.23	0.00	1.38	8.54
Ogden [3]	3.87	3.92	4.23	1.23	0.85	0.54	0.40	0.12	0.07	1.36	0.00	2.22	18.61
Ogden [4]	2.09	4.05	1.74	1.69	0.85	0.56	0.54	0.23	0.24	0.75	0.00	1.86	14.60
Parawan	-----	-----	-----	-----	-----	-----	-----	-----	0.93	0.59	0.43	0.34	-----
Park City	0.00	0.80	0.40	0.00	0.00	-----	-----	-----	-----	-----	0.00	1.42	-----
Price	0.08	0.05	0.02	0.00	0.00	0.00	0.00	0.10	0.25	0.00	0.00	0.00	0.50
Promontory	1.80	0.70	0.40	0.30	0.00	0.00	0.00	0.00	0.00	1.10	0.00	0.40	4.70
Provo City	1.04	0.50	0.60	0.00	1.00	-----	-----	-----	-----	0.00	0.00	-----	-----
Richfield	[2.20]	[2.00]	h0.61	1.51	0.06	T.	0.52	0.30	0.53	0.51	T.	0.38	[8.62]
Saint George	2.97	1.05	1.47	1.04	0.00	0.00	0.00	0.15	1.20	0.00	1.24	0.55	9.67
Salt Lake City	3.07	2.05	1.12	0.94	0.16	0.32	0.02	0.79	T.	1.44	T.	0.42	10.33
Snowville	[0.20]	[0.80]	[1.10]	1.66	1.97	0.12	0.27	0.09	0.34	0.91	0.00	0.19	[7.65]
Stockton	0.00	0.80	0.00	0.00	0.09	-----	-----	-----	-----	0.00	0.00	-----	-----
Taylors' Ranche	1.05	1.00	0.60	0.78	0.03	T.	n0.09	a0.85	0.50	1.20	0.90	0.56	7.56
Terrace	1.35	0.45	0.35	0.15	0.15	0.15	0.00	0.00	0.15	0.05	0.00	0.30	3.10

[1] Signal Service. [2] U. S. post surgeon. [3] Pacific Railroad System. [4] Bell Telephone Co.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Vermont:													
Brattleboro	3.10	3.98	5.11	1.47	5.00	2.77	2.87	8.29	6.18	7.17	[c]1.56	4.16	51.66
Burlington	2.05	1.98	[3.40]	1.93	6.12	2.57	3.33	6.76	3.84	2.02	2.31	1.90	[38.21]
Chelsea	3.80	3.85	2.93	2.68	5.35	3.11	2.49	7.20	4.54	4.09	2.25	3.32	45.61
Cornwell	3.13	3.80	3.44	2.24	5.49	2.50	2.31	6.00	2.96	2.03	1.28	2.74	37.92
East Berkshire	4.29	3.89	2.40	1.51	6.16	3.64	4.20	9.83	4.02	3.50	4.25	3.37	51.06
Hartland	1.95	3.24	3.47	2.10	6.50	2.75	2.81	6.37	4.44	5.61	2.09	3.50	44.83
Jacksonville	4.31	6.13	5.48	1.79	5.87	2.34	3.28	6.56	6.46	9.30	2.50	5.05	59.07
Lunenburg	3.20	2.68	4.14	2.02	6.59	4.57	3.56	6.14	3.92	2.75	2.46	3.10	45.13
Northfield	2.76	3.29	2.54	1.94	4.32	2.84	2.87	6.98	2.95	3.49	2.28	1.91	38.17
Strafford	3.70	4.40	3.70	2.10	7.60	2.90	4.00	8.85	3.95	4.80	2.00	3.30	51.30
Vernon	3.31	4.93	5.17	1.91	5.19	1.83	3.01	6.46	6.75	6.66	1.96	2.18	49.36
Virginia:													
Abingdon	2.63	5.43	4.62	5.46	4.27	1.74	3.86	5.49	3.70	4.34	1.05	5.40	47.99
Alexandria	......	......	1.17	3.24	4.46	1.67	......	......	......	......	......	......	......
Birdsnest	1.02	1.90	3.65	4.50	7.05	2.15	3.55	4.05	9.25	5.80	T.	6.30	49.22
Bolar	0.70	4.45	3.15	1.08	6.95	3.62	1.32	2.99	2.89	5.51	0.57	4.79	38.02
Cape Henry	1.10	1.33	3.71	3.12	2.27	3.51	5.10	7.41	9.42	3.79	0.12	4.43	45.29
Casanova	......	......	......	......	......	......	2.79	5.32	4.81	4.66	0.37	2.74	......
Christiansburg	1.00	3.99	2.30	1.89	5.50	2.60	2.86	3.78	3.89	3.87	0.05	1.77	33.50
Dale Enterprise	0.57	3.83	3.24	2.34	5.68	5.01	2.73	1.26	3.65	3.07	0.55	3.46	35.39
Fall Creek	......	......	......	......	3.71	2.44	11.37	4.89	2.16	4.39	0.00	5.70	......
Fort Monroe	0.77	1.90	3.44	4.28	6.86	1.27	6.99	6.74	7.17	3.16	0.00	4.39	46.97
Fort Myer	1.19	4.07	3.38	2.85	4.85	2.34	2.65	5.36	3.63	4.28	0.84	3.87	39.31
Lexington	1.01	5.13	4.02	1.82	3.93	5.04	2.93	2.04	3.40	4.90	0.63	3.60	38.45
Liberty (Bedford City)	1.49	4.69	2.48	1.59	3.85	2.61	3.31	2.77	4.32	4.17	0.55	3.26	35.09
Lynchburg	1.59	4.22	3.16	1.98	4.71	1.63	4.83	3.81	1.94	5.18	0.03	5.14	38.22
Marion	2.36	6.66	4.16	3.98	6.51	1.31	4.94	3.40	4.52	3.99	0.43	3.20	45.46
Mossingford	1.37	3.79	3.78	2.02	5.91	2.77	5.79	3.75	4.03	7.45	0.20	4.82	45.68
Norfolk	1.13	1.98	4.06	3.70	4.03	2.79	6.33	9.36	6.64	3.96	0.23	6.01	50.22
Nottaway	1.45	4.43	3.85	2.41	7.08	3.03	6.19	3.33	5.85	5.74	0.13	[3.70]	[47.19]
Petersburg	1.07	2.70	3.57	2.94	5.31	1.95	3.81	3.85	4.29	8.10	0.06	3.70	41.35
Richmond	1.31	3.13	3.49	2.85	4.50	1.52	4.19	3.26	6.20	9.00	0.11	3.91	43.47

Salem	0.92	6.06	3.00	2.11	3.83	5.44	[2.94]	[3.80]	[2.60]	4.09	0.10	3.68	[38.53]
Smithfield	0.87	1.90	3.88	3.32	7.31	2.59	5.39	5.37	[k]2.18	[7.40]	[0.15]	[4.80]	[45.16]
Spottsville	0.90	3.00	4.95	1.95	------	------	------	------	------	------	------	------	------
Staunton	0.74	[4.60]	0.60	1.70	3.75	3.75	2.01	1.62	3.33	5.51	0.38	3.23	[31.22]
Woodstock	0.52	4.87	3.99	2.76	5.53	3.73	1.59	3.71	1.76	4.82	0.51	4.45	38.24
Wytheville	------	------	------	------	------	1.56	1.35	4.55	3.07	3.80	0.49	2.74	------
Yanceys Mills	------	------	------	------	------	------	[n]2.50	1.45	6.01	5.06	0.47	2.73	------
Washington:													
Blakely	7.71	4.88	2.90	1.54	0.45	1.61	0.50	0.26	0.07	3.09	0.56	7.73	31.30
Chehalis	------	------	------	------	0.80	1.87	0.56	0.84	0.43	3.00	0.73	5.31	------
Doe Bay	1.13	1.97	3.00	0.98	1.25	2.39	1.34	0.25	0.19	4.78	1.27	4.48	23.03
East Sound	------	------	------	------	------	[1]2.63	[1]0.87	0.31	0.29	5.65	1.47	6.62	------
Fort Canby[1]	12.07	7.37	7.23	3.67	1.76	3.46	1.45	2.53	0.34	5.32	1.77	6.98	53.95
Fort Canby[2]	8.06	5.60	5.80	4.18	1.95	3.45	1.15	1.22	0.34	6.56	1.94	8.91	49.16
Fort Simcoe	[6.00]	[5.00]	[5.39]	0.19	0.28	0.00	0.00	0.00	0.04	0.00	0.05	1.10	[14.96]
Fort Spokane	4.20	1.08	0.58	0.20	2.40	2.65	0.45	0.20	0.95	0.70	0.00	0.45	13.86
Fort Townsend	4.65	1.91	2.17	0.90	0.94	1.59	1.01	0.30	0.15	2.07	0.96	3.30	19.95
Fort Walla Walla	2.14	1,88	2.59	0.28	0.98	1.59	0.00	0.06	0.02	0.84	0.00	0.63	11.01
Lapush	------	------	------	------	0.61	5.22	2.81	0.48	0.58	8.50	3.86	11.24	------
Olympia	8.36	7.71	3.76	1.49	0.31	1.96	0.45	0.38	0.07	2.56	0.71	8.11	35.88
Port Angeles	7.05	4.76	1.73	1.61	0.73	2.71	1.14	0.00	------	------	------	------	------
Seattle	------	------	------	------	------	------	------	0.15	0.01	3.05	0.69	5.89	------
Spokane Falls	3.19	3.15	2135	0.38	1.58	1.98	0.38	0.38	0.88	1.02	0.06	1.23	16.57
Tatoosh Island	13.00	6.54	8.20	5.24	2.58	5.89	2.91	[1.15]	0.66	13.69	8.00	19.57	[87.53]
Tacoma	7.08	7.58	2.49	2.51	0.89	2.45	0.55	0.48	0.22	3.74	0.88	5.50	35.37
Vancouver Banks	12.55	7.81	4.49	1.16	1.10	2.43	0.85	0.15	0.00	2.79	0.80	3.84	37.97
Vashon	0.43	2.69	------	------	------	------	0.02	0.04	T.	2.48	0.09	------	------
Walla Walla	2.53	1.35	2.45	0.38	1.36	1.42	0.07	0.14	0.38	0.77	0.01	9.34	11.80
Waterville	3.16	0.89	1.16	0.70	1.67	1.52	0.30	T.	0.00	0.55	T.	0.80	10.75
West Virginia:													
Buckhannon	5.26	6.16	7.62	5.10	6.03	8.28	3.06	3.79	5.63	8.59	2.54	5.49	67.55
Charleston	3.82	6.98	8.90	4.41	7.55	3.19	3.28	8.87	3.63	3.28	1.84	4.45	60.20
Ella	5.48	5.12	5.53	3.56	6.93	7.10	1.63	8.22	6.06	5.96	2.43	4.59	62.61
Glenville	4.35	6.97	7.54	4.08	5.46	4.85	5.11	7.72	6.67	6.96	2.89	6.04	68.64
Harpers Ferry	0.50	3.09	2.87	2.40	4.56	2.15	2.32	5.54	3.97	5.35	0.69	3.16	36.60
Hinton	0.11	0.43	1.95	3.78	4.40	4.00	3.47	3.49	2.17	4.06	0.84	3.29	31.99
Morgantown	5.83	5.87	5.84	4.13	8.10	6.83	3.41	7.08	7.71	8.20	2.67	3.87	69.54
Oceana	3.94	7.99	7.48	3.55	6.33	4.62	3.27	5.93	4.10	5.50	[0.80]	[3.80]	[56.91]

[1] Signal Service.

[2] U. S. post surgeon.

MONTHLY AND ANNUAL PRECIPITATION (IN INCHES AND HUNDREDTHS) FOR 1890—Continued.

Stations.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
West Virginia—Continued.													
Parkersburg	4.30	5.67	6.95	3.41	6.57	4.84	6.06	5.84	8.41	3.85	2.57	4.20	62.67
Point Pleasant	4.01	6.08	7.54	5.05	5.58	2.82	4.48	10.26	5.83	4.20	2.97	4.26	63.08
Rowlesburg	4.69	6.54	4.46	6.14	8.09	4.67	2.92	5.44	4.39	4.62	2.22	3.28	56.46
Tyler Creek	3.81	----	----	5.29	----	3.45	6.75	5.70	3.41	2.93	3.46	----	----
Weston	4.15	5.73	4.80	4.75	9.06	8.21	4.03	7.94	5.64	7.84	2.94	3.11	68.20
Wheeling	5.05	4.70	5.26	6.21	6.65	6.89	2.73	6.88	7.24	7.36	1.33	3.98	64.28
White Sulphur Springs	1.85	4.71	7.72	2.20	3.47	3.21	3.10	0.92	2.95	3.96	0.90	1.71	36.70
Wisconsin:													
Beloit	----	----	----	----	----	6.66	0.28	3.98	0.61	4.56	2.16	0.55	----
Butternut	1.02	5.42	*15.10	1.58	3.73	3.77	6.46	5.76	4.75	3.12	0.94	0.39	52.04
Cadiz	----	----	----	3.16	0.46	10.96	0.05	0.18	0.27	----	1.22	0.80	----
Chippewa Falls	1.38	0.66	1.71	2.54	5.14	4.79	1.50	4.05	6.52	3.34	0.48	0.44	32.55
Delavan	2.49	1.98	1.45	2.30	4.69	----	----	----	----	----	2.98	2.16	----
Embarrass	3.75	3.10	2.00	3.70	4.40	6.60	5.80	7.05	3.40	2.35	1.85	1.05	45.05
Fond du Lac	[1.20]	[2.70]	[1.00]	3.20	3.85	3.47	2.33	2.89	1.86	5.69	1.99	0.75	[30.93]
Glasgow	[1.50]	1.30	0.55	3.24	4.41	[8.90]	1.90	4.55	3.72	5.23	1.91	0.32	[37.53]
Grantsburg	1.20	1.70	2.25	0.46	3.84	10.76	6.17	7.51	2.50	1.55	0.71	[0.20]	[38.85]
Green Bay	3.29	3.16	1.86	2.75	3.08	5.18	4.50	4.61	1.77	3.57	1.72	0.75	36.24
Greenwood	2.66	2.48	2.59	2.71	4.35	5.47	3.36	3.88	5.18	3.38	1.02	1.13	38.21
Hayward	1.01	0.86	0.80	----	----	----	----	----	3.45	2.56	0.91	0.28	----
Honey Creek	[2.50]	0.89	2.03	2.09	5.35	6.00	0.40	2.40	0.40	3.90	1.92	0.68	[28.56]
Horicon	1.58	----	1.20	0.69	2.13	----	----	----	----	----	----	----	----
Ithaca	----	----	----	----	----	----	----	3.46	2.50	5.23	1.88	0.41	----
Hoepenick	----	----	----	----	----	----	----	----	6.20	3.60	0.90	0.55	----
La Crosse	1.57	0.80	0.63	1.77	4.20	8.91	1.46	3.47	5.20	5.14	1.24	0.38	34.77
Lincoln	0.99	1.19	1.65	4.88	2.91	5.32	4.05	3.74	2.68	1.16	2.40	0.22	31.19
Madison	1.81	2.01	2.38	2.22	5.03	7.72	1.81	4.23	2.62	4.59	1.93	0.62	36.97
Manitowoc	3.32	2.88	1.92	3.26	3.33	4.00	3.92	2.23	1.12	4.42	1.81	0.65	32.86
Medford	1.19	1.56	1.76	1.70	4.38	4.50	3.43	6.17	7.87	3.68	0.80	0.80	37.84
Milwaukee	2.51	1.94	2.68	2.84	4.95	4.09	1.77	3.18	0.65	2.96	2.02	0.50	30.09
Oshkosh	3.01	2.70	1.67	3.56	4.75	7.62	2.83	5.04	1.54	5.89	2.18	0.86	41.65
Phillips	1.71	1.52	1.40	1.50	4.23	6.80	6.75	9.88	4.62	2.57	0.71	0.15	41.84

Plover	-------	-------	-------	-------	-------	-------	-------	10.91	4.07	2.02	1.46	0.33	-------
Portage	2.89	1.53	1.80	4.87	5.40	6.04	2.25	3.89	2.94	5.35	1.33	1.34	39.63
Potosi	-------	-------	-------	-------	6.25	10.40	1.40	6.57	2.85	6.17	-------	-------	-------
Summit Lake	2.57	2.35	2.32	1.75	3.55	10.00	3.80	7.30	-------	-------	-------	-------	-------
Wawzeka	-------	3.10	-------	T.	-------	-------	T.	-------	2.00	8.00?	2.20	0.40	-------
Weston	-------	-------	-------	0.80	3.83	1.04	-------	-------	-------	-------	-------	1.50	-------
Wyoming:													
Camp Pilot Butte	1.38	1.25	0.46	0.78	0.39	0.07	0.18	0.61	0.37	0.25	0.54	0.91	7.20
Camp Sheridan	6.70	6.65	4.92	1.39	1.86	0.90	0.99	1.77	0.19	1.68	0.49	0.89	28.43
Carbon	0.58	2.26	0.59	2.01	1.16	-------	-------	-------	-------	-------	-------	-------	-------
Carter	1.80	0.65	0.90	0.55	-------	-------	-------	-------	-------	-------	-------	-------	-------
Cheyenne	0.16	0.59	0.17	3.93	0.81	0.65	3.64	3.18	T.	0.76	0.47	0.11	14.47
Fort Bridger	1.13	1.60	0.75	0.78	0.42	0.16	0.06	0.44	0.14	[0.00]	[0.50]	[0.90]	[6.88]
Fort D. A. Russell	0.40	0.24	0.44	8.07	1.93	0.41	3.14	2.44	0.00	8.79	0.13	0.00	17.99
Fort Fetterman	-------	-------	-------	-------	T.	T.	T.	0.00	-------	T.	0.34	0.00	-------
Fort McKinney[1]	0.15	0.50	0.86	0.76	1.83	1.14	0.88	0.88	0.01	1.20	0.05	0.03	8.29
Fort McKinney[2]	0.14	0.72	1.00	0.65	1.55	1.80	0.97	1.08	0.27	0.80	T.	T.	8.98
Fort Washakie[1]	0.97	0.31	0.74	0.64	0.46	0.44	0.97	0.73	0.40	1.82	0.26	T.	7.74
Fort Washakie[2]	1.36	0.16	0.78	0.53	0.58	0.03	1.10	0.77	0.30	2.69	9.06	0.00	8.36
Lander	0.81	0.32	0.40	0 47	-------	-------	-------	-------	-------	-------	-------	-------	-------
Laramie	-------	-------	-------	-------	-------	-------	-------	-------	0.40	0.90	0.40	0.10	-------
Lusk	0.14	0.46	1.87	3.80	2.70	0.50	1.10	0.87	0.10	0.42	T.	T.	11.96
Owen	-------	-------	-------	-------	2.91	0.11	2.91	0.90	0.05	-------	-------	-------	-------
Saratoga	1.60	4.25	3.10	0.67	4.46	1.00	0.94	1.53	[0.00]	1.43	1.00	[0.10]	[20.08]
Wheatland	-------	1.23	1.02	4.10	1.01	0.00	0.20	-------	-------	-------	-------	0.00	-------

* Rainfall estimated. [1] Signal Service. [2] U. S. post surgeon.

APPENDIX 16.

DATES OF THE FIRST AND LAST KILLING FROSTS FOR THE SEASON 1890–'91.

[Compiled from reports of Signal Service and voluntary observers.]

[When no frost has been recorded the first and last occurrence of a temperature of 32° has been entered in the table.]

States and stations.	First.	Last.
Alabama:		
Auburn	Nov. 1	Apr. 6
Bermuda	Nov. 1	Apr. 6
Citronelle	Nov. 4	Apr. 6
Columbiana	Oct. 31	Apr. 6
Double Springs	Oct. 31	Apr. 6
Decatur	Oct. 28	....
Evergreen	Nov. 1	....
Fort Deposit	Nov. 1	....
Livingston	Nov. 29	Apr. 6
Marion	Oct. 31	....
Mount Vernon Barracks	Nov. 1	Apr. 6
Mobile	Nov. 4	Apr. 6
Montgomery	Oct. 31	Apr. 6
Opelika	Oct. 31	....
Pine Apple	Nov. 1	....
Tuscumbia	Oct. 28	....
Valley Head	Oct. 28	....
Arizona:		
Ash Canyon	Dec. 6	....
Bangharts	Oct. 15	....
Bisbee	Nov. 13	....
Cooleys	....	May 30
Cottonwood	Oct. 25	....
Crittenden	Oct. 11	....
Dos Cabezos	Nov. 9	....
Dudleyville	Oct. 12	Mar. 31
Eagle Pass	Nov. 9	Apr. 3
Fort Apache	Oct. 12	May 1
Fort Bowie	Nov. 16	Mar. 11
Fort Grant	Nov. 9	Mar. 9
Fort Huachuca	Nov. 7	Mar. 18
Fort Lowell	Nov. 9	....
Fort Thomas	Nov. 17	Apr. 2
Grand Central Mills	Nov. 9	....
Holbrook	Oct. 12	Apr. 26
Lochiel	Nov. 8	....
Mount Huachucha	Nov. 8	Mar. 31
Natural Bridge	Nov. 15	....
Prescott	Oct. 12	May 30
San Carlos	Nov. 13	Apr. 3
Showlow	Oct. 6(?)	....
Signal	Nov. 17(?)	Mar. 8
Strawberry	Oct. 13	....
Arizona—Cont'd.		
Tucson	Nov. 8	Mar. 9
Walnut Grove	Oct. 11	....
Walnut Ranch	Oct. 12(?)	....
Wilcox	Oct. 18	Apr. 19
Wilgus	Nov. 20	....
Woodruff	Nov. 5(?)	....
Yuma	Jan. 7	Feb. 11
Arkansas:		
Camden	Oct. 31(?)	Apr. 6
Conway	Oct. 31	Apr. 4
Dallas	Oct. 7	Apr. 5
Devall Bluff	Dec. 1	Apr. 6
Fayetteville	Dec. 2	Apr. 5
Forrest City	Oct. 31	Mar. 15
Fort Smith	Oct. 27	Apr. 6
Harrisburg	Oct. 26	Apr. 5
Helena	Dec. 4	Mar. 14
Hot Springs	Oct. 27	Apr. 6
Lead Hill	Oct. 27	Apr. 6(?)
Little Rock	Dec. 4	Apr. 4
Lonoke	Nov. 23	Apr. 5
Mount Nebo	Nov. 3	Apr. 5
Newport	Dec. 5	Mar. 21
Osceola	Oct. 27	Apr. 4
Ozone	Nov. 3	Apr. 5
Pine Bluff	Dec. 1	Apr. 5
Russellville	Dec. 1	....
Stuttgart	Oct. 27	Apr. 5
Texarkana	Dec. 4	Mar. 17
Washington	Nov. 3	....
Winslow	Oct. 27	Mar. 19
California:		
Alcatraz Island	Dec. 27	Dec. 27
Anderson	Dec. 13	Feb. 25
Angel Island	(*)	(*)
Barstow	Dec. 8	Feb. 11
Benicia Barracks	Oct. 3	Feb. 8
Berkeley	Dec. 11	Dec. 11(?)
Crescent City	Oct. 2	Mar. 28(?)
Eureka	Nov. 7	Mar. 29
Fort Bidwell	....	May 31
Fort Gaston	Oct. 11	Mar. 24
Fort Mason	(*)	(*)
Fresno	Dec. 9	Mar. 29
Georgetown	Nov. 7	Apr. 7(?)

*No frost during season.

DATES OF FIRST AND LAST KILLING FROST FOR THE SEASON 1890-'91—Cont'd.

States and stations.	First.	Last.
California—Cont'd.		
Grass Valley	Nov. 7	-----
Hydesville	Nov. 8	Mar. 29
Iowa Hill	Dec. 31	Apr. 7
Julian	Jan. 8	May 9
Keeler	Oct. 10	Apr. 8
Los Angeles	(*)	(*)
Los Gatos	Jan. 10	Feb. 10
Mount Hamilton	Oct. 9	-----
Mullans	Nov. 7	-----
National City	Jan. 9	Jan. 12
North Hill Vineyard	Dec. 12	Feb. 2
Oakland[1]	Jan. 9	Feb. 25
Placerville	Nov. 7	Apr. 8
Point Reyes Light	(*)	(*)
Presidio of San Francisco	Dec. 4	Dec. 4
Red Bluff	Dec. 10	Feb. 25
Riverside	Jan. 1	Feb. 12
Sacramento	Nov. 7	Feb. 10
Salinas	Jan. 12	Feb. 11
San Diego	(*)	(*)
San Francisco	(*)	(*)
Santa Cruz	Jan. 9	Feb. 10
Santa Maria	Jan. 9	Mar. 24
Sonoma	Dec. 11	Feb. 20(?)
Steele	Jan. 11	Jan. 11
Susanville	Oct. 8	Apr. 8
Upper Mattole	Oct. 10	Feb. 9
Vacaville	Dec. 10	Jan. 13
Volta	Jan. 8	Feb. 12
Walla Walla Creek	Oct. 3	May 8
Walnut Creek	Jan. 10	Jan. 13
Wheatland	Dec. 10	Feb. 25
Willow	Dec. 10	Feb. 25
Colorado:		
Beaver Creek	Sept. 8(?)	-----
Bennett	Oct. 18	-----
Cañon City	Oct. 14	-----
Castle Rock	Sept. 13	-----
Colorado Springs	Sept. 13	-----
Crook	Sept. 19	-----
Deer Trail	Oct. 15	-----
Denver s. s	Sept. 13	May 21
Eagle Farm	Sept. 13	-----
Fort Collins	Sept. 8	May 2
Fort Lewis	Sept. 7	May 17
Fort Logan	Aug. 13	Apr. 16
Fort Morgan	Oct. 5	-----
Fruita	Sept. 8	-----
Hugo	Oct. 14	-----
Husted	Sept. 8	-----
Julesburg	Sept. 13	-----
Lamar	Oct. 14	-----
Las Animas	Sept. 23	-----
Le Roy	Sept. 19	-----
Colorado—Cont'd.		
Longmont	Sept. 8	-----
Magnolia	Oct. 5	-----
Montrose	Sept. 8	Apr. 26
Morrison	Sept. 13	-----
Pagosa Springs	Sept. 8	-----
Parachute	Sept. 8	-----
Pinkhampton	Sept. 19(?)	-----
Pueblo	Oct. 14	Apr. 16
Ranch near Como	Sept. 4	-----
Rifle Falls	Sept. 23	-----
Rocky Ford	Sept. 12	May 19
San Luis experiment station	Sept. 7	May 5
Sheridan Lake	Oct. 16	-----
Stamford	Sept. 6	-----
Sterling	Sept. 19	-----
Villa Grove	Sept. 6	-----
Watkins	Oct. 8	-----
Yuma	Oct. 14	-----
Connecticut:		
Fort Trumbull	Nov. 1	May 6
Hartford	Sept. 25	May 6
Meriden	Oct. 20	May 7
New Hartford	Sept. 25	May 6
New Haven	Oct. 22	May 7
New London	Sept. 25	May 6
Southington	Sept. 25	May 6
Voluntown	Sept. 25	May 6
Delaware:		
Dover	Oct. 31	Apr. 9
District of Columbia:		
Kendall Green	Oct. 31	Apr. 9
Washington	Oct. 31	Apr. 9
Florida:		
Alva	Jan. 6	Apr. 7
Archer	Dec. 10	Apr. 7
Duke	Dec. 10	Apr. 7
Eustis	Dec. 29	Dec. 29
Fort Barrancas	Dec. 9	Apr. 6
Fort Meade	Dec. 19	Apr. 6
Homeland	Dec. 29	Apr. 7
Jacksonville	Dec. 29	Apr. 6
Jupiter	Jan. 14	Apr. 7
Key West	(*)	(*)
Ocala	Dec. 10	Jan. 20
Orange City	Dec. 10	Apr. 7
Pensacola	Dec. 9	Apr. 6
San Antonio	Dec. 29	Apr. 7
Tallahassee	Dec. 10	Apr. 6
Tampa	Dec. 29	Dec. 29
Titusville	Dec. 29	Apr. 7
Villa City	Dec. 28	-----
Georgia:		
Albany	Nov. 1	-----
Americus	Nov. 1	-----
Athens	Oct. 28	Apr. 6

* No frost during season.

DATES OF FIRST AND LAST KILLING FROST FOR THE SEASON 1890-'91—Cont'd.

States and stations.	First.	Last.
Georgia—Cont'd.		
Atlanta	Oct. 31	Apr. 6
Augusta	Nov. 1	Apr. 6
Bainbridge	Nov. 2	----------
Blakely	Nov. 1	Apr. 6
Camak	Nov. 2	----------
Cartersville	Oct. 28	----------
Diamond	Oct. 28	Apr. 5
Eastman	Nov. 2	----------
Forsyth	Nov. 1	Apr. 6
Fort Gaines	Nov. 1	----------
Fort McPherson	Nov. 1	Apr. 6
Gainesville	Oct. 28	----------
Gillsville	Nov. 29	Apr. 5
Griffin	Oct. 31	----------
Hephzibah	Dec. 13	Mar. 15
Lithia Springs	Oct. 28	----------
Marietta	Oct. 31	Apr. 6
Milledgeville	Nov. 1	Apr. 6
Millen	Nov. 1	----------
Monticello	Oct. 29	Apr. 5
Newnan	Oct. 27(?)	----------
Perry	Oct. 27(?)	----------
Point Peter	Nov. 1	Apr. 6
Poulan	Nov. 1	Apr. 6
Quitman	Dec. 10	Apr. 6
Savannah	Dec. 10	Apr. 5
Toccoa	Oct. 28	----------
Union Point	Oct. 31	----------
Washington	Oct. 28	----------
Waynesboro	Nov. 1	----------
Woolleys Ford	Oct. 28	----------
Idaho:		
American Falls	Sept. 7	May 20
Beaver	Sept. 7	----------
Boisé Barracks	Oct. 3	May 8
Bonanza	Aug. 8	May 31
Era	Sept. 7	May 20
Fort Sherman	Sept. 12	May 9
Henry's Lake	Aug. 20	June 30
Kootenai	Oct. 9	May 1
Mullan	Sept. 7	May 9
Payette	Sept. 7	May 9
Placerville	----------	May 13
Soda Springs	Aug. 8	----------
Illinois:		
Aurora	Sept. 17	May 17
Cairo	Oct. 31	April 4
Charleston	Oct. 27	----------
Chicago	Oct. 27	Apr. 8
Cockrell	Oct. 20	Apr. 8
Collinsville	Oct. 27	Apr. 7
Fort Sheridan	Sept. 13	May 16
Hennepin	Sept. 28	May 18
Lacon	Oct. 20	Apr. 7
Louisville	Oct. 20	----------
Olney	Oct. 20	Apr. 5
Oswego	Sept. 13	May 17(?)
Ottawa	Oct. 20	Apr. 13
Palestine	Oct. 20	May 6
Peoria	Oct. 27	Apr. 7
Illinois—Cont'd.		
Philo	Sept. 14	May 17
Riley	Sept. 17	May 6
Rockford	Sept. 28	May 6
Rock Island Arsenal	Oct. 27	May 4
Rushville	Oct. 27	----------
Sandwich	Sept. 28	May 17
South Evanston	Sept. 13	May —
Springfield	Sept. 13	Apr. 8
Sycamore	Sept. 20	May 27
Indiana:		
Indianapolis	Oct. 21	May 7
Jeffersonville	Nov. 1	May 7
La Fayette	Oct. 21	May 17
Mauzy	Nov. 1	May 7
Point Isabel	Sept. 14	May 7
Seymour	Oct. 21	May 7
Sunman	Oct. 29	----------
Valparaiso	Oct. 30	May 6
Vevay	Oct. 30	Apr. 12
Indian Territory:		
Fort Supply	Sept. 30	Apr. 5
Healdton	Dec. 7	Mar. 12
Iowa:		
Afton	Sept. 13	----------
Alta	Sept. 13	May 6
Amana	Sept. 28	May 6
Ames	Sept. 13	May 6
Atlantic	Sept. 13	May 18
Bancroft	Sept. 28	May 17
Belle Plaine	Sept. 13	Apr. 9
Blakevile	Oct. 19?	May 4
Carroll	Sept. 13	May 17
Carson	Sept. 13	----------
Cedar Falls	Sept. 27	May 18
Cedar Rapids	Sept. 28	May 6
Clarinda	Oct. 19	Apr. 7
Clinton	Oct. 20	May 17
Cresco	Sept. 8	May 6
Davenport	Sept. 13	May 5
Des Moines	Sept. 13	May 11
Dubuque	Sept. 28	May 6
Eagle Grove	Sept. 13	May 5
Fayette	Sept. 13	May 27
Fort Madison	Sept. 28	Apr. 5
Glenwood	Sept. 30	Apr. 7
Greenfield	Sept. 13	May 6
Grinnell	Sept. 13?	Apr. 8
Hampton	Sept. 13	May 6
Humboldt	Sept. 13	May 6
Independence	Oct. 27	Apr. 8
Indianola	Oct. 19	May 26
Iowa City	Sept. 13	Apr. 8
Keokuk	Oct. 19	Apr. 8
Larrabee	Sept. 13	May 4
Logan	Sept. 13	May 17
Mason	Sept. 13	May 6
Maquokota	Sept. 28	Apr. 7
McCausland	Oct. 20	May 27?
Monticello	Sept. 28	May 11

DATES OF FIRST AND LAST KILLING FROST FOR THE SEASON 1890-'91—Cont'd.

States and stations.	First.	Last.
Iowa—Cont'd.		
Mount Pleasant	Oct. 27	Apr. 5
Muscatine	Sept. 28	....
Osage	Sept. 13	May 5
Oskaloosa	Sept. 13	May 7?
Panama	Sept. 12	May 6
Sac City	Sept. 17	May 6
Sioux City	Sept. 29	Apr. 7
Stilson	Sept. 13	May 7
Storm Lake	Sept. 13	May 4?
Vinton	Sept. 28	May 6
Washington	Sept. 13?	May 11
Webster City	Sept. 13	May 6
West Bend	Sept. 13	May 6
Kansas:		
Allison	Sept. 13	Apr. 5
Alton	Sept. 13	....
Altoona	Oct. 19	May 7
Columbus	Oct. 18?	Apr. 5
Concordia	Sept. 29	May 11
Cunningham	Sept. 13	May 11
Dodge City	Oct. 14	May 11
Downs	Sept. 13	May 13?
Elk Falls	Oct. 13	Apr. 3?
Emporia	Oct. 27	Apr. 5
Englewood	Oct. 16	Apr. 5
Ft. Leavenworth	Oct. 27	Apr. 5
Fort Riley	Oct. 31	Apr. 5
Fremont	Sept. 13	Apr. 14
Globe	Oct. 27	Apr. 5
Gove City	Oct. 14	Apr. 14
Havensville	Sept. 13	May 11
Horton	Oct. 27	Apr. 5
Independence	Sept. 13	Apr. 11
Kansas City	Sept. 13	Apr. 5
La Crosse	Oct. 25	Apr. 5
La Harpe	Oct. 27	Apr. 7
Lakin	Sept. 8	May 11
Larned	Sept. 13	....
Lawrence	Oct. 27	....
Leavenworth	Oct. 27	Apr. 5
Lebo	Oct. 27	May 11
Macksville	Sept. 13	May 11
Manhattan	Sept. 13	May 11
Morse	Oct. 27	Apr. 4
Norton	Sept. 13	....
Oswego	Oct. 27	Apr. 5
Salina	Sept. 13	May 10
Sedan	Nov. 3	Apr. 5
Seneca	Oct. 19	Apr. 7
Shields	Nov 3	May 11
Topeka	Oct. 26	Apr. 11
Tribune	Oct. 14	Apr. 14
Wakefield	Sept. 13	Apr. 5
Wichita	Oct. 14	Apr. 5
Kentucky:		
Caddo	Nov. 20	May 7
Canton	Oct. 31	Apr. 5
Central City	Oct. 31	May 6
Earlington	Oct. 31	Mar. 15
Edmonton	Oct. 28	Apr. 5
Kentucky—Cont'd.		
Frankfort	Oct. 17	May 6
Franklin	Oct. 31	Apr. 5
Harrodsburg	Oct. 15	May 7
Lexington	Oct. 30	May 7
Louisville	Oct. 28	Apr. 5
Mount Sterling	Oct. 21	May 7
Newport Bar'cks	Nov. 1	May 7
Pellville	Oct. 30?	May 7
Princeton	Oct. 20	May 6
Richmond	Oct. 21	May 7
Shelbyville	Oct. 20	May 7
Louisiana:		
Alexandria	Nov. 4	....
Amite City	Nov. 1	....
Cheneyville	Nov. 1	....
Coushatta	Nov. 4	....
Jackson Barr'cks	Dec. 9	Jan. 26
La Fayette	Nov. 4	....
Liberty Hill	Oct. 27?	Apr. 6
Marksville	Oct. 27	Apr. 6
Minden	Nov. 4	....
Natchitoches	Nov. 4	....
New Orleans	Dec. 10	Jan. 14
Port Eads	....	Jan. 19
Shreveport	Nov. 4	Mar. 13
Maine:		
Cornish	Sept. 25	Apr. 20
Eastport	Oct. 10	Apr. 30
Farmington	Sept. 24	May 23
Fort Preble	Oct. 22	May 6
Kennebec Ars'n'l	Oct. 6	May 10
Kents Hill	Oct. 21	May 7
Orono	Sept. 25	May 6
Portland	Oct. 21	May 5
Maryland:		
Baltimore	Oct. 31	Apr. 6
Barren Creek Springs	Oct. 31	May 6?
Cumberland	Sept. 29	Apr. 9
Fallston	Oct. 31	Apr. 7
Fort McHenry	Nov. 20	Apr. 7
Frederick	Oct. 22?	Apr. 9
Gaithersburg	Oct. 22?	Apr. 8
McDonogh	Nov. 5?	Apr. 7
Mt. St. Marys	Oct. 30	Apr. 8
Woodstock	Oct. 31	Apr. 9
Massachusetts:		
Amherst	Sept. 25	May 19
Blue Hill (Val'y)	Sept. 25	May 6
Boston	Oct. 22	May 6
Brewster	Nov. 4	....
Cambridge	Oct. 22	May 6
Chestnut Hill	Oct. 22	May 6
Concord	Sept. 25	May 18
Dudley	Oct. 22	May 7
Fall River	Oct. 22	May 6
Fort Warren	Oct. 24	Apr. 9
Heath	Sept. 25	May 19
Leicester	Sept. 28	....
Ludlow	Sept. 25	May 20

DATES OF FIRST AND LAST KILLING FROST FOR THE SEASON 1890-'91—Cont'd.

States and stations.	First.	Last.
Massachu'ts—Con.		
Milton	Sept. 25	May 6
Nahant	Nov. 4	May 6
Nantucket	Nov. 21	May 28
New Bedford	Oct. 22	May 6
Newburyport	Oct. 22	—
North Billerica	Sept. 25	May 6
Royalston	Sept. 24	Apr. 9
Somerset	Oct. 22	May 6
Springfield Armory	Oct. 22	May 6
Taunton	Oct. 22	May 6
Vineyard Haven	Nov. 21	Apr. 6
Westboro	Sept. 25	May 19
Worcester	Sept. 25	—
Wood's Holl	Nov. 4	Apr. 8
Michigan:		
Albion	Sept. 28	May 26
Alpena	Aug. 24	May 17
Berrien Springs	Aug. 23	—
Birmingham	Sept. 14	May 16
Detroit	Oct. 21	May 17
Escanaba	Sept. 28	May 26
Fort Brady	Sept. 26	May 26
Fort Mackinac	Oct. 18	May 17
Fort Wayne	Oct. 21	May 27
Grand Haven	Sept. 28	May 17
Hudson	Sept. 13	May 26
Jackson	Sept. 28	May 16
Kalamazoo	Oct. 29	May 6
Lansing	Sept. 14	May 27
Manistee	Sept. 17	May 17
Manton	Aug. 23	—
Marquette	Sept. 24	May 26
Marshall	Aug. 23	May 27
Mottville	Oct. 20	May 7
Port Huron	Sept. 29	May 17
Sault Ste. Marie	Sept. 27	May 26
Thornville	Aug. 23	May 17
Ypsilanti[1]	Sept. 28	May 27
Minnesota:		
Duluth	Sept. 28	May 5
Faribault	Oct. 15	May 17
Fort Snelling	Sept. 13	May 6
Le Sueur	Oct. 15	May 6
Marshall	Sept. 27	—
Minneapolis	—	May 5
Montevideo	Sept. 13	May 10
Moorhead	Sept. 8	May 25
Morris	Sept. 13	May 5
Red Wing	—	May 6
St. Charles	Sept. 37	May 5
St. Paul	Sept. 27	May 5
St. Vincent	Aug. 22	May 26
Sheldon	Sept. 28	May 5
Mississippi:		
Aberdeen	Oct. 28	—
Agr'l College	Oct. 31	Apr. 5
Batesville	Oct. 31	—
Booneville	Dec. 13	Apr. 5
Brookhaven	Nov. 1	—
Mississippi—Con.		
Canton	Nov. 4	Apr. 5
Columbus	Nov. 1	—
Corinth	Oct. 31	—
Edwards	Nov. 4	—
Enterprise	Oct. 31	Apr. 5
Greenville	Dec. 8	Mar. 15
Hazlehurst	Nov. 1	—
Hernando	Oct. 31	—
Holly Springs	Oct. 31	—
Jackson	Nov. 1	—
Kosciusko	Oct. 31	Apr. 6
Lake	Oct. 27	—
Louisville	Oct. 31	Apr. 6
Meridian	Oct. 27	Apr. 6
Moss Point	Dec. 8	Apr. 4
Natchez	Nov. 4	—
Okolona	Oct. 31	—
Palo Alto	Oct. 31	—
Pearlington	Nov. 4	Feb. 27
Pontotoc	Oct. 31	—
Port Gibson	Oct. 27	—
Rienzi	Oct. 31	—
University	Oct. 31	Apr. 5
Vaiden	Oct. 28	Apr. 6
Vicksburg	Nov. 4	Apr. 6
Washington	Nov. 4	Apr. 5
Water Valley	Oct. 31	Apr. 4
Waynesboro	Nov. 4	Apr. 6
West Point	Nov. 4	Apr. 5
Missouri:		
Adrian	Sept. 12	May 26
Appleton City	Oct. 27	Apr. 5
Austin	Oct. 27	Apr. 5
Brunswick	Oct. 27	Apr. 7
Carrolton	Oct. 26	Apr. 6
Columbia	Oct. 23	May 6
Darkesville	Sept. 13	May 6
Eldon	Oct. 31	May 6
Excelsior Sp'gs.	Sept. 13	May 11
Fayette	Oct. 23	May 6
Glenwood	Sept. 13	—
Grand Pass	Oct. 27	Apr. 7
Hannibal	Oct. 27	—
Harrisonville	Oct. 19	Apr. 5
Hermann	Oct. 27	Apr. 4
Ironton	Oct. 31	—
Kansas City	Oct. 19	Apr. 5
Kidder	Sept. 13	—
Lebanon	Oct. 27	Apr. 5
Lamar	Sept. 15	—
Liberty	Sept. 13	Apr. 13
Marshall	Oct. 31	Apr. 7
New Haven	Oct. 31	Apr. 5
Oak Ridge	Oct. 31	Apr. 4
Oregon	Sept. 13	May 6
Pickering	Sept. 13	May 16
Platt Riv. (near)	Sept. 13	May 1
Princeton	Oct. 19	May 6
St. Louis	Oct. 27	Apr. 7
Sarcoxie	Oct. 19	Apr. 5

DATES OF FIRST AND LAST KILLING FROST FOR THE SEASON 1890-'91—Cont'd.

States and stations.	First.	Last.
Missouri—Cont'd.		
Sedalia	Oct. 27	Apr. 5
Springfield	Oct. 14	Apr. 5
Steelville	Oct. 20	----------
Stellada	Oct. 27	Apr. 5
Warrentown	Oct. 27	----------
Willow Springs	Oct. 27	----------
Withers Mill	Oct. 19	May 6
Montana:		
Assinniboine, Fort.	Sept. 11	May 20
Blackfeet Agency.	Sept. 5	----------
Camp Popular River.	Sept. 11	May 4
Choteau	Sept. 11	May 23
Custer, Fort	Sept. 14	May 4
Glendive	Sept. 19	May 3
Helena	Sept. 7	May 3
Keogh, Fort	Sept. 11	May 20
Logan, Fort	Sept. 6	----------
Martindale	Sept. 5	May 20
Missoula, Fort	Sept. 11	June 10
Powder River	Sept. 13	May 21
Shaw, Fort	Sept. 11	May 21
Virginia City	(*)	----------
Woodworth	(*)	----------
Alliance	Sept. 2	May 10
Ansley	Sept. 12	May 26
Beaver City	Sept. 13	Apr. 5
Creighton	Sept. 13	Apr. 15
Crete	Sept. 13	Apr. 11
De Sota	Oct. 19	Apr. 7
Fort Niobrara	Sept. 9	May 26
Fort Omaha	Sept. 12	Apr. 7
Fort Robinson	Sept. 12	May 4
Fort Sidney	Sept. 13	Apr. 29
Fremont	Sept. 13	Apr. 5
Genoa	Sept. 13	Apr. 14
Gering	Oct. 4	May 3
Harvard	Sept. 13	Apr. 7
Hay Springs	Sept. 7	May 11
Kennedy	Sept. 12	----------
Kimball	Sept. 8	May 27
Lexington	Sept. 13	May 11
Lincoln (Univ. of Nebr.)	Oct. 26	Apr. 7
North Loup	Sept. 12	May 10
North Platte	Sept. 19	Apr. 14
Omaha	Sept. 28	Apr. 7
Syracuse	Sept. 13	Apr. 4
Tecumseh	Sept. 13	May 17
Valentine	Sept. 13	May 4
Weeping Water	Sept. 13	Apr. 11
Nevada:		
Beowawe	Sept. —	Apr. —
Carson City	Oct. 3	May 10
Eli	Sept. —	May —
Pioche	Sept. —	May —
Winnemucca	Sept. 6	Apr. 25
New Hampshire:		
Berlin Falls	Aug. 7	June 9
Concord	Sept. 25	May 6
East Canterbury	Sept. 24	Apr. 24
Hanover	Sept. 25	June 6
Manchester	Sept. 25	May 19
Nashua	Sept. 25	May 19
North Sutton	Sept. 25	
New Jersey:		
Atlantic City	Nov. 1	Apr. 9
Beverly	Oct. 31	May 6
Egg Harbor City	Oct. 31	May 6
New Brunswick	Oct. 31	May 6
Readington	Oct. 31	
Woodbury	Sept. 25	Apr. 9
New Mexico:		
Albert	Nov. 9	May 15
Albuquerque	Oct. 12	----------
Carthage	----------	Ap. 3
Chama	Sept. 8	June 16
Coolidge	Oct. 6	June 14
Estalina Springs	Oct. 16	June 2
Fort Bayard	Oct. 13	May 27
Fort Stanton	Oct. 7	Apr. 25
Fort Union	Sept. 11	----------
Fort Wingate	Oct. 5	May 31
Gallinas Springs	Nov. 11	Apr. 5
Hillsboro	Nov. 3	Apr. 5
Hills Ranch	Oct. 13	Apr. 20
La Luz	Nov. 16	----------
Lava	Oct. 22	----------
Las Lunas	Oct. 4	June 1
Santa Fé	Oct. 13	May 5
New York:		
Albany	Oct. 22	Apr. 9
Angelica	Sept. 25	----------
Binghamton	Sept. 25	----------
Buffalo	Sept. 25	May 23
Canton	Sept. 25	May 27
Constableville	Sept. 25	----------
Davids Island	Oct. 30	May 7
Factoryville	Sept. 28	----------
Fort Hamilton	Nov. 24	Apr. 5
Fort Niagara	Nov. 4	May 6
Fort Porter	Nov. 3	May 6
Fort Schuyler	Oct. 30	Apr. 9
Fort Wadsworth	Oct. 31	May 6
Geneva	Sept. 25	May 27
Hess Road Station	Sept. 25	----------
Humphrey	Sept. 25	----------
Ilion	Sept. 25	----------
Ithaca	Oct. 22	----------
Lowville	Sept. 25	May 6
Madison Barracks	Sept. 28	May 4
Marshland	Sept. 25	May 27
Middleburg	Sept. 25	----------
New Lisbon	Sept. 25	----------
New York City	Oct. 31	May 27

* Has a minimum of 32° or less each month of year.

DATES OF FIRST AND LAST KILLING FROST FOR THE SEASON 1890-'91—Cont'd.

States and stations.	First.	Last.	States and stations.	First.	Last.
New York—Cont'd.			Ohio—Cont'd.		
Number Four	Sept. 25	Apr. 7	Kenton	Oct. 31	May 17
Ogdensburg	Sept. 25		Leipsic	Sept. 14	
Oswego	Oct. 31	May 27	Napoleon	Oct. 21	May 17
Palmer	Sept. 25	June 5	North Lewisburg	Oct. 30	May 17
Plattsburg Barracks	Oct. 22	May 19	Orangeville	Oct. 22	May 27
Rochester	Sept. 29	May 27	Portsmouth	Nov. 1	May 17
South Kortright	Sept. 25		Sandusky	Oct. 22	May 17
Watervliet Arsenal	Sept. 24	May 6	Shiloh	Oct. 31	
			Tiffin	Sept. 29	May 17
West Point	Oct. 14	May 6	Toledo	Oct. 21	May 27
Willets Point	Nov. 5	Apr. 9	Vienna	Oct. 22	
North Carolina:			Wauseon	Oct. 21	May 27
Asheville	Oct. 21	May 6	Westerville	Sept. 28	May 17
Chapel Hill	Oct. 28	May 6	Oklahoma:		
Charlotte	Oct. 28	Apr. 6	Guthrie	Nov. 26	Apr. 5
Goldsboro	Nov. 1		Oklahoma City		Apr. 5
Hatteras	Dec. 14	Mar. 15	Reno, Fort	Nov. 3	Apr. 5
Highlands	Oct. 15	May 6	Sill, Fort	Nov. 3	Apr. 5
Hendersonville	Oct. 28	May 6	Oregon:		
Hot Springs	Oct. 20		Albany	Oct. 10	Apr. 3
Kitty Hawk	Dec. 13	Mar. 15	Astoria	Nov. 6	Mar. 11
Lenoir	Oct. 21	May 7	Baker City	Sept. 6	May 9
Lumberton	Oct. 28		Bandon	Oct. 13	Mar. 9
Morganton	Oct. 21	May 6	Beulah	Sept. 1	May 8
Mount Airy	Oct. 21	May 8	Eola	Oct. 10	Apr. 3
Mount Pleasant	Oct. 28	May 6	Grants Pass	Oct. 8	May 8
Newberne	Nov. 1		Happy Valley	Sept. 1	May 21
Oak Ridge	Oct. 21	May 7	Heppner	Sept. 12	May 21
Raleigh	Oct. 28	May 7	Joseph	Sept. 6	May 10
Soapstone, Mt	Oct. 28	May 6	Lake View	Oct. 1	May 30
Southport	Nov. 1	Apr. 5	McMinnville	Oct. 10	May 8
Washington	Oct. 28	May 6	Mount Angel	Oct. 10	Apr. 3
Weldon	Nov. 1	May 6	Portland	Nov. 6	Mar. 31
Wilmington	Nov. 1	Mar. 15	Roseburg	Oct. 9	Mar. 31
North Dakota:			Pennsylvania:		
Bismarck	Sept. 13	May 5	Aqueduct	Oct. 31	Apr. 9
Bufort, Fort	Sept. 12	May 15	Blooming Grove	Sept. 25	May 6
Gallatin	Sept. 12	May 25	Blue Knob	Sept. 1	May 6
Davenport	Sept. 13		Corry	Sept. 25	May 27
Kelso	Aug. 22		Dyeberry	Sept. 25	May 19
Napoleon	Aug. 4	May 25	Edinboro	Oct. 28	May 7
Mew England City	Sept. 13		Erie	Oct. 18	May 5
			Franklin	Sept. 29	
Steele	Sept. 8		Grampian Hills	Sept. 1	May 27
Wahpeton	Aug. 22	May 25	Harrisburg	Oct. 22	April 9
Wild Rice	Sept. 12	May 3	Kilmer	Oct. 31	April 6
Yates, Fort	Sept. 12	May 25	Le Roy	Sept. 25	May 17
Ohio:			Nisbet	Oct. 31	April 5
Bement	Oct. 22	May 17	Philadelphia	Oct. 31	April 6
Cincinnati	Nov. 1	Apr. 8	Phillipsburg	Sept. 1	
Cleveland	Oct. 21	May 17	Phoenixville	Oct. 31	May 6
Columbus	Oct. 27	May 6	Pittsburg	Oct. 31	May 17
Demos	Oct. 31	May 17	Pleasant Mount	Oct. 31	May 6
Elyria	Oct. 21		Quakertown	Sept. 25	May 28
Garrettsville	Oct. 18	May 17	Salem Corners	Sept. 25	May 6
Gratiot	Oct. 30	May 17	State College	Sept. 25	May 6
Hassan	Oct. 21		Tipton	Sept. 25	
Jacksonboro	Oct. 31	May 6	Troy	Oct. 22	May 5

DATES OF FIRST AND LAST KILLING FROST FOR THE SEASON 1890-'91—Cont'd.

States and stations.	First.	Last.	States and stations.	First.	Last.
Penn'a—Cont'd.			Tenn.—Cont'd.		
Wellsboro	Sept. 28	May 27	Bolivar	Oct. 31	....
West Chester	Oct. 31	May 6	Brownsville	Oct. 31	....
Westtown	Oct. 31	Apr. 7	Chattanooga	Oct. 28	Apr. 6
Rhode Island:			Covington	Oct. 31	Apr. 6
Block Island	Nov. 5	Apr. 7	Cumberland Gap	Oct. 28	....
Fort Adams	Nov. 4	May 7	Dyersburg	Oct. 31	....
Kington	Oct. 22	....	Grand Junction	Oct. 31	....
Narragansett Pier	Oct. 13	Apr. 7	Knoxville	Oct. 28	Apr. 6
South Carolina:			Memphis	Oct. 31	Apr. 4
Allendale	Nov. 1	....	Milan	Oct. 31	....
Batesburg	Oct. 31	....	Nashville	Oct. 28	Apr. 5
Blackville	Nov. 29	....	Riddleton	Oct. 28	Apr. 6
Branchville	Oct. 28	....	Texas:		
Charleston	Dec. 28	Feb. 27	Abilene	Nov. 27	Mar. 26
Cheraw	Oct. 28	Apr. 6	Berlin	Nov. 28	Apr. 5
Columbia	Oct. 28	Apr. 7	Brady	Nov. 28	Apr. 5
Florence	Nov. 28	....	Brownsville	(*)	(*)
Greenville	Oct. 28	....	Brownwood	Nov. 28	Apr. 5
Greenwood	Oct. 28	....	Camp del Rio	Oct. 13	Mar. 9
Jacksonboro	Nov. 30	....	Camp Eagle Pass	Nov. 28	Mar. 8
Kingstree	Nov. 1	....	Camp Peña Colorado	Oct. 23	Apr. 7
Kirkwood	Oct. 28	Apr. 6	Childress	Nov. 3	Apr. 4
St. Georges	Nov. 30	....	College Station	Dec. 8	Mar. 13
St. Matthew	Nov. 1	....	Coldwater	Oct. 15	....
Simpsonville	Oct. 28	Apr. 6	Corpus Christi	(*)	(*)
Spartanburg	Oct. 15	....	Corsicana	Nov. 3	April 5
Statesburg	Oct. 28	Apr. 5	Cuero	Nov. 4	....
South Dakota:			El Paso	Nov. 16	Mar. 15
Aberdeen	Sept. 8	May 25	Fort Bliss	Nov. 16	Mar. 11
Alexandria	Sept. 13	May 13	Fort Clark	Dec. 9	Mar. 9
Brookings	Sept. 5	May 17	Fort Davis	Nov. 15	Apr. 2
Canton	Sept. 13	Apr. 14	Fort Hancock	Oct. 13	Apr. 22
Clark	Sept. 6	May 16	Fort McIntosh	Nov. 27	Feb. 4
Flandreau	Sept. 13	May 6	Fort Ringgold	Dec. 7	Feb. 12
Fort Bennett	Sept. 13	May 10	Fort Sam Houston	Dec. 8	Mar. 9
Fort Meade	Sept. 19	May 10	Gallinas	Nov. 4	Mar. 9
Fort Randall	Sept. 13	May 8	Galveston	(*)	(*)
Fort Sully	Sept. 19	May 5	Graham	Nov. 3	Apr. 5
Highmore	Sept. 13	....	Grapevine	Nov. 27	Apr. 5
Howard	Sept. 12	May 4	Hartley	Oct. 13	....
Huron	Sept. 13	May 16	Hearne	Nov. 4	....
Millbank	Sept. 13	May 4	Houston	Nov. 4	Mar. 13
Oelrichs	Sept. 6	May 9	La Grange	Nov. 28	....
Onida	Sept. 13	May 21	Lampasas	Nov. 28	....
Rapid City	Sept. 13	May 10	Luling	Nov. 28	Mar. 9
St. Lawrence	Aug. 22	May 4	Menardville	Nov. 28	Mar. 13
Scranton	Sept. 13	....	Merkel	Nov. 26	....
Sioux Falls	Sept. 13	....	Mesquite	Nov. 27	Apr. 5
Spearfish	Oct. 18	May 10	New Braunfels	Nov. 28	Apr. 13
Vermillion	Sept. 13	....	Orange	Nov. 4	....
Webster	Aug. 22	....	Palestine	Dec. 8	Mar. 27
Wolsey	Sept. 13	May 3	Panhandle	Nov. 3	Apr. 5
Woonsocket	Aug. 22	....	Panther	Nov. 27	Apr. 4
Yankton	Sept. 13	....	Rio Grande City	Dec. 9	Jan. 24
Tennessee:			Round Rock	Nov. 28	Apr. 5
Arlington	Nov. 28	....	San Antonio	Dec. 8	Mar. 9
Ashwood	Oct. 31	Apr. 5			

*No frost during season.

DATES OF FIRST AND LAST KILLING FROST FOR THE SEASON 1890-'91—Cont'd.

States and stations.	First.	Last.	States and stations.	First.	Last.
Texas—Cont'd.			Washington—Con.		
Silver Falls	Oct. 16	Apr. 5	Lapush	Sept. 22	....
Venus	Nov. 3	Apr. 5	Noah Bay	Nov. 6	Apr. 3
Utah:			Olympia	Oct. 9	May 9
Alta	Sept. 7	....	Port Angeles	....	Apr. 23
Beaver	Sept. 7	May 11	Spokane Falls	Oct. 8	May 9
Fort Du Chesne	Sept. 8	Apr. 22	Tatoosh Island	Oct. 11	Mar. 27
Grouse Creek	Sept. 2	....	Vancouver Barracks	Sept. 9	Apr. 20
Losee	Oct. 1	June 1	Walla Walla	Nov. 6	Apr. 1
Moab	Sept. 8	Apr. 26	Waterville	Sept. 22	May 9
Mount Carmel	Oct. 12	Apr. 27	West Virginia:		
Mount Pleasant	Sept. 7	June 27	Ella	Nov. 1	Apr. 7
Nephi	Oct. 3	May 12	Mount Alto	Oct. 27	....
Ogden	Oct. 15	Mar. 31	Oceana	Oct. 28	....
Park City	Oct. 4	Apr. 25	Parkersburg	Nov. 1	Apr. 9
Paroway	Sept. 7	Apr. 26	Pleasant Hill	Oct. 27	May 17
St. George	Oct. 4	Apr. 20	Tannery	Nov. 1	Apr. 26
Salt Lake City	Oct. 4	Apr. 9	Tyler Creek	Oct. 23	May 7
Taylor's Ranch	Sept. 7	May 11	Wisconsin:		
Vermont:			Butternut	Sept. 16	May 4
Brattleboro	Sept. 25	May 19	Cadiz	Sept. 28	May 16
Lunenburg	Sept. 25	Apr. 29	Embarrass	Sept. 20	May 23
Northfield	Sept. 25	May 24	Fond du Lac	Sept. 28	June 7
Strafford	Sept. 25	May 19	Grantsburg	Sept. 13	....
Virginia:			Green Bay	Sept. 20	May 17
Bedford City	Oct. 30	Apr. 8	Greenwood	Aug. 23	....
Birds Nest	Nov. 4	Mar. 8	Hayward	Sept. 16	June 5
Bolar	Oct. 30	....	Honey Creek	Sept. 17	May 16
Cape Henry	Nov. 29	Mar. 16	Ithaca	Sept. 28	May 6
Casanova	Oct. 31	Apr. 8	Koepenick	Sept. 16	May 15
Christiansburgh	Oct. 30	May 7	La Crosse	Sept. 27	May 5
Dale Enterprise	Sept. 23	May 7	Lincoln	Oct. 30	....
Fall Creek	Oct. 21	....	Madison	Oct. 27	May 5
Fort Monroe	Nov. 27	....	Manitowoc	Sept. 28	May 26
Fort Myer	Oct. 28	Apr. 9	Milwaukee	Oct. 20	May 5
Lexington	Oct. 31	May 8	Neillsville	Sept. 13	....
Lynchburg	Nov. 1	May 7	Oshkosh	Oct. 20	May 16
Marion	Oct. 21	May 8	Plover	Sept. 16	May 26
Norfolk	Nov. 1	Mar. 18	Peshtigo	....	June 5
Nottoway	Oct. 28	May 7	Wacousta	Sept. 13	....
Petersburg	Oct. 31	May 6	Wyoming:		
Richmond	Oct. 28	May 6	Camp Pilot Butte	Aug. 24	June 10
Salem	Nov. 5	Apr. 9	Camp Sheridan	Sept. 3	....
Staunton	Oct. 30	May 6	Cheyenne	Sept. 8	May 22
Summit	Oct. 30	May 8	Fort Bridger	Sept. 7	....
Wytheville	Oct. 21	....	Fort D. A. Russell	Aug. 17	June 21
Yanceys Mills	Oct. 31	Apr. 13	Fort Fetterman	Aug. 19	May 26
Washington:			Fort McKinney	Sept. 12	May 11
Blakeley	Dec. 5	Apr. 3	Fort Washakie	Sept. 7	May 23
Chehalis	Oct. 10	Apr. 3	Lusk	Sept. 6	May 16
Doe Bay	Dec. 5	Mar. 31	Owen	Sept. 7	....
East Sound	....	Mar. 12			
Fort Canby	Feb. 8	Mar. 4			
Fort Spokane	Sept. 12	Apr. 25			
Fort Townsend	Nov. 7	Apr. 3			
Fort Walla Walla	Sept. 1	Apr. 8			

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APPENDIX 17.

INTERNATIONAL PRESSURE AND STORM CHARTS.

By A. W. Greely,

Brigadier-General, Chief Signal Officer, U. S. Army.

In pursuance of a plan of coöperation agreed on and recommended by the representatives of the various nations constituting the Vienna Meteorological Congress of September, 1873, the work of inaugurating a system of international daily simultaneous meteorological observations was begun by Col. and Bvt. Brig. Gen. Albert J. Myer, Chief Signal Officer of the United States Army, in the fall of 1873.

Under the agreement entered into by Gen. Myer at Vienna, the United States assumed the entire expense connected with this international work, and the office staff and force of the Signal Service were charged with the task of preparing the observations for publication on a uniform plan and in both English and metric measures.

On July 1, 1875, the daily issue of a printed bulletin, wherein were incorporated the international simultaneous meteorological observations, was commenced at the office of the Chief Signal Officer of the Army, and a copy of it was regularly furnished to each coöperating observer and to the important scientific institutions. By November 1, 1875, the number of simultaneous reports received from stations outside of the United States had reached two hundred and sixty-eight.

The work thus commenced rapidly developed, and proved the most gigantic, important, and successful undertaking in the history of meteorology. During thirteen years, 1875 to 1887, inclusive, the land observations of this service covered the countries of almost the entire Northern Hemisphere and a part of the Southern Hemisphere, reports were received from regular naval and merchant marine vessels of the principal countries of the Northern Hemisphere, and over 150,000 monthly reports, representing upward of 5,000,000 daily simultaneous observations, were received at the office of the Chief Signal Officer at Washington City.

The coöperation of the United States Navy commenced in 1877, in accordance with a general order of the Secretary of the Navy dated December 25, 1876, and the example of this country was speedily followed by other nations.

Observations were received from a number of vessels of the merchant marine during 1877, and substandard barometers for comparing and correcting ships' barometers were placed in the Maritime Exchange, New York City, and in the Merchants' Exchange, San Francisco, Cal. In the case of maritime observers the United States was to the expense of forms, stationery, postage, and in many instances also furnished instruments.

Through the coöperation of the navies of Great Britain, France, Sweden, Italy, and Portugal, and of a number of the great steamship companies, foreign and domestic, and also of the "New York Herald Weather Service," the number of vessels reporting was increased to over 400 by 1882. In this year marine agencies for the collection of vessel reports and the comparison of instruments were established at the principal seaports of the Atlantic coast, and a considerable number of instruments for taking observations were issued to vessels of the United States Navy and to captains of vessels of the merchant marine engaged in the work. As a result of the establishment of the marine agencies, the number of vessels furnishing daily simultaneous observations rapidly increased, and at the close of 1887, when this branch of the service was transferred to the Hydrographic Office, Navy Department, reports were received from nearly 600 vessels.

On July 1, 1878, so extended and effectual was the coöperation of other countries that it became possible for the Chief Signal Officer to commence the issue of a series of daily international weather charts for issue to the coöperating observers and gratuitous distribution to scientific institutions throughout the world. The map from the first issue presented in graphic form weather data for the whole of the northern hemisphere. The preparation of these maps may be characterized as a visible step in the progress of civilization, since it exhibited for the first time in history the material proof of an earnest and practical coöperation, devoid of distrust or jealousy, of all civilized powers of the Northern Hemisphere.

The study of these charts led at once to the consideration of such questions as those of storm translation from continent, of the general movements of the atmosphere as illustrated both by the prevailing winds and annual march of barometric pressure, and of many others. It thus resulted that the charting of storm tracks over the whole of the Northern Hemisphere was soon after commenced and issued for each month, and still later the series of monthly storm-tracks was extended backward to include January, 1877.

The number of foreign land stations eventually increased to a total of 459, which with the maritime and polar stations made about 1,100 stations outside of the United States from which simultaneous meteorological observations were at some time made and regularly transmitted to the Chief Signal Officer of the Army. It is the first instance in which any considerable number of nations united to undertake in the interest of science alone, a work requiring continuous application on a magnificent scale. The following-named countries coöperated during a part or the whole of the period, 1875 to 1887: Algeria, Australia, Austria-Hungary, Belgium, Brazil, Great Britain, Canada, Cape Colony, Chile, China, Costa Rica, Denmark, Egypt, France, Germany, Greece, Hawaiian Islands, India, Italy, Japan, Mauritius, Mexico, The Netherlands, Norway, Russia, Scotland, Spain, Sweden, Switzerland, and Turkey. In addition to the reports furnished by the regular services of the several countries observations were made and forwarded from Newfoundland, Cuba, Jamaica, Bermuda, and other islands of the North Atlantic Ocean, Central America, northern South America, Bering Island, the Aleutian Islands, Greenland, and Iceland.

At a meteorological congress held in Rome, Italy, in April, 1879, the work of international observations was encouraged; and the publications of the United States Signal Service were mentioned as models of work to be desired in Europe. By resolutions of the meteorological congresses at Hamburg, in 1879, and at St. Petersburg, 1881, details for the establishment of polar stations were arranged, and it was definitely understood that the series of polar observations should begin August 1, 1882. One of the United States expeditions, under the command of First Lieut. A. W. Greely, Fifth Cavalry, Acting Signal Officer and Assistant, sailed from St. John, Newfoundland, July 7, 1881, and reached Lady Franklin Bay August 11, 1881; the other, under the command of First Lieut. P. H. Ray, Eighth Infantry, Acting Signal Officer, sailed from San Francisco, Cal., July 18, 1881, and arrived at Point Barrow, Alaska, September 8, 1881. International polar stations were also established as follows: By Austria-Hungary, at Jan Mayen; by Denmark, at Godthaab; by Finland at Sodalynka; by France, at Orange Bay, Cape Horn; by Germany, at Kingawa Fiord, Cumberland Sound, and at Royal Bay, S. Georgian Islands: by Great Britain and Canada, at Fort Rae, British America; by Holland, at Dicksonhaven; by Norway, at Bossekop; by Russia, at the Lena Delta and Nova Zembla; and by Sweden, at Spitzbergen.

The international publications of the Signal Service, which commenced with the regular issue of the Daily Bulletin of Simultaneous Observations in July, 1875, embody data whose value cannot be overestimated. The network of stations which covered the Northern Hemisphere for a period of years furnished a vast number of reliable observations, the study of which has in no small measure contributed to recent discoveries and advances in meteorology, and in future investigations these observations will be invaluable. In the following table are given the dates upon which the several international publications were commenced and discontinued:

Name of publication.	Date commenced.	Date discontinued.
Daily Bulletin of Simultaneous Observations.	July 1, 1875	June 30, 1884.
Monthly Mean Charts of Pressure and Temperature of Northern Hemisphere.	January, 1877	December, 1887.
Storm-track Charts of Northern Hemisphere.	November, 1877	December, 1887.
Daily International Maps	July 1, 1878	June 30, 1884.
Do	October 1, 1886	December 31, 1887.
*Monthly Summary and Review	July, 1880	December, 1887.
Monthly Summary	January, 1888	June, 1889.

* Prior to 1883 this subject was embodied in the Monthly Weather Review.

With the virtual discontinuance of international work in 1888, the Chief Signal Officer ordered the preparation of a monthly summary of observations showing for each station of the international series the means of ten years (1878 to 1887, inclusive) observations. This summary was prepared, together with charts Nos. 1 to 12, showing the mean monthly pressure and prevailing wind over the Northern Hemisphere, under the personal direction of Mr. Edward B. Garriott, formerly of the Signal Corps. Additional charts (Nos. 13 to 24) were prepared showing the normal pressure, changes from month to month over the Northern Hemisphere, and a chart (No. 25) showing in figures the entire number of storm-centers which passed in ten years over each square of 5°, and by lines of most frequent tracks of such storms.

These publications and charts are based upon an unparalleled series of observations; they represent graphically the labor of meteorologists throughout the civilized world for a period of thirteen years; they are unique in the annals of meteorology; and their proper presentation, rendered impracticable heretofore owing to insufficient funds, is alone needed to class them with the most treasured products of modern meteorology.

On assuming charge of the duties pertaining to this work, in January, 1887, the present Chief Signal Officer found many difficulties besetting the continuance of this important but very extensive work. The issue of the daily international charts had long since been practically abandoned, owing to lack of sufficient means to continue their publication on the scale and in the manner which had obtained for some years previous. Further, the observations from coöperating countries were in some instances so long delayed that the plan of publishing the data just one year in arrears was impracticable unless large areas were left blank on the maps. By adopting some new methods, the present Chief Signal Officer was able to resume the preparation and publication of daily maps and monthly bulletins for a considerable portion of the arears in addition to keeping up the current publications. The delays on the part of some coöperating countries continued, however, and after careful consideration of the question it seemed advisable to discontinue the daily maps and the Monthly Review, but still continue the publication of the Monthly Summary of such observations as might reach the office of the Chief Signal Officer within twelve months after the date of observations. This plan went into operation on January 1, 1889, and has been continued to date.

MONTHLY PRESSURE CHARTS.

Charts Nos. 1 to 12 graphically indicate for each month of the year the mean barometric pressure and prevailing winds for noon, Greenwich time, as determined from the international simultaneous meteorological observations from 1878 to 1887. In addition, the international simultaneous observations have been supplemented by data at points where such observations have never been made, or have been taken for brief periods of time. Many of these nonsimultaneous observations are at points in the Arctic regions, occupied either in carrying out the programme of international polar expeditions, or in connection with voyages of exploration or search. The greater part of the observations on which these charts depend, however, are those of the simultaneous scheme, and the accompanying means, page 760 *et seq.*, are for a period of 10 years.

The collation, reduction, and final preparation of the detailed data for the separate months from January, 1878, to December, 1887, on which these mean charts ultimately depend, were performed almost entirely under the direction and supervision of Prof. Cleveland Abbe, Maj. H. H. C. Dunwoody, Signal Corps; Capt. John P. Story, Fourth Artillery; Capt. Robert Craig, Signal Corps, and the present Chief Signal Officer while serving as a subaltern. In addition to these should be mentioned the valuable work done by the chief clerks, Messrs. Theodore Smith, J. B. Walton, George A. Warren, and Edward B. Garriott, all formerly observer sergeants of the Signal Corps, who very materially aided not only in the collection of the data, but also in the drawing of isometric lines and discussion of the subject in hand.

The charts of mean pressures and prevailing winds are particularly valuable with reference to the North Atlantic; and no doubt exists that the average meteorological condition of this most important of ocean highways have been determined with an accuracy approximating that of equal land areas in America or Asia. These data are of great and almost indispensable value to sea captains traversing the North Atlantic.

With reference to continental areas, the data are not as full as that used in preparing local charts, consequently the same amount of labor and consideration has not been given to land data as to that for the ocean. The pressure observations being simultaneous, it results that they are made at some places at the hour of the daily maximum and at others during the prevalence of the minimum. In consequence, these means of Greenwich noon are not directly comparable with the mean pressure of the entire day, which usually serve as a basis for charts of these phenomena.

The main value, apart from that already referred to, is the furnishing of a standard or normal chart for each month, with which the months of abnormal pressure can be compared. By such analytical study can be determined the effects on other concurrent or ensuing meteorological conditions resulting from an unusual distribution of pressure in any month or season.

NORMAL PRESSURE CHANGES FROM MONTH TO MONTH.

On charts Nos. 13 to 24 are shown the mean changes which take place from one month to another in the barometric pressure over the northern hemisphere. In the preparation of these maps the readings of the barometer reduced for instrumental error and to the standard temperature of 32° have been used. In this manner it has been possible to use some isolated and important data, such as that of Fort Rae in North America, and at stations of unknown elevation in the interior of Siberia. Any discrepancies as between changes of reduced barometric pressure for the same period must be slight and unimportant except at stations of considerable altitude above the sea.

The Chief Signal Officer has several times expressed his belief in the importance which must eventually attach to the annual barometric fluctuations, and is confident that a careful study will reveal their intimate connection with the prevalent types of weather or climate, so that abnormal departures in certain regions will be recognized as dominating factors in producing later in the season abnormal weather conditions in other and quite distant sections of the world.

The fact that dissimilar types of atmospheric fluctuations obtained during the year in different parts of the world was forced on the attention of the Chief Signal Officer while serving at Fort Conger, Grinnell Land, in 1882, when he determined by observation and comparative study that a very marked type of annual atmospheric fluctuation obtained in Arctic America, with its primary maximum in April, its secondary maximum in November, and the primary and secondary minimum in July and January, respectively.

Later, a brief memoir on these questions was read before the National Academy of Sciences in 1885, and the substance thereof incorporated in the official report of the Lady Franklin Bay Expedition the same year.

It needs only a casual examination of these change charts to convince the student that the old idea of the air simply flowing from land to sea in summer and from sea to land in winter can no longer be received, even as a general statement of the complex atmospheric changes which occur during the year in various parts of the world.

During January, for instance, it is to be seen that the pressure increases over the South Atlantic Ocean, but it decreases very materially over the North Atlantic, between Portugal and the British Isles on the east and Newfoundland and Greenland on the west. During this time the pressures increase very largely over Europe to the west and northeastern Asia to the east, while over the intermediate region is to be noted a decided decrease from India northward to the Arctic Ocean.

From January to February is seen, it is true, a slight increase over the regions of the South Atlantic, near the Azores, but there occurs at the same time a very decided decrease over far the greater part of the North Atlantic. In the mean time the whole of Arctic America and the Bering Sea region experience a large increase.

From February to March the Southeastern Atlantic shows a marked falling off in its pressure, while the northern portions between the British Isles and Greenland and Arctic America present diametrically opposite changes. Similar but somewhat less marked changes also occur over these same regions from March to April.

From April to May, if we note the very rapid rise in the pressure of the Central Atlantic, it is also found extending over the greater part of Europe. From June to July the pressure increases over the South Atlantic, it is true, but it decreases in a large ratio over the extreme North Atlantic. It is evident, also, that the pressure decreases over Arctic America, but it increases over the greater part of the United States. From July to August the pressure gives way over the Atlantic and Europe, but over the greater part of the United States and in Asia and the adjacent seas it increases quite decidedly. Similar changes discordant, according to the old theory, may be noted in the other months.

The annual fluctuations of atmospheric pressure may be classified under two general divisions or types, the first of which is expressed by a curve with a single inflection, while the last is in the form of a curve with two inflections or bends. The single-inflection curve fluctuations are most general, while the double-inflection curve in the northern hemisphere obtains in the polar or subpolar regions, in Europe, northern Africa, and over a part of the Atlantic Ocean. These annual atmospheric waves, with their crests and troughs, must move over the northern hemisphere somewhat in the same manner as the waves of high pressure, known as cold waves, move throughout the winter months from the interior of the American continent to the Atlantic seaboard. Doubtless, too, one simple law, dependent to greater or less extent on the relative positions of the earth and sun, underlies this annual fluctuation; but barometric data now available have not yet been sufficiently analyzed to permit any simple expression of this law.

This annual fluctuation of the atmospheric pressure is a difficult problem which has not yet been fully solved for the entire northern hemisphere. Personal investigations made by the Chief Signal Officer show it to be more than probable that the maximum pressure occurs for the year over British America and part of Greenland in April, and that it moves slowly southeastward, covering Iceland, Norway, and Sweden, and the northern portion of the British Isles in May. The movement of this air farther southward across Europe and Africa is marked by a secondary maximum in June and July, while the maximum for central Africa apparently occurs in August. This indicates that at least a part of these maxima pressures are due to a movement southeastward of cold air, chilled by the radiation of the long polar night of high latitudes. A secondary maximum in November covers the greater part of the arctic zone, whence, the air moving southward, gives a primary maximum over Europe and the greater portion of India in December. The rest of Asia has a well-marked maximum in January and February, during which month the greatest pressure also obtains over the greater portion of the United States, northern Africa and the Atlantic Ocean. The principal minimum occurs over Asia in July, excepting in the greater part of India, where it obtains in June. The principal minimum of April covers the United States, the Atlantic Ocean, and the Mediterranean Sea, and adjacent regions between the thirtieth and fortieth parallels of latitude.

The curve showing the annual oscillations at Fort Conger coincides closely and regularly with the observations of the many expeditions in Arctic America since the commencement of this century. This marked double oscillation doubtless obtains annually at the north geographical pole, and hence is styled the polar type. A principal maximum in April gives away rapidly to the primary minimum in July, followed by a well-marked and complete secondary wave, the crest of which appears in November and the trough in January.

A second type, called the American, a single annual curve, obtains in America and in parts of Europe, and over the Mediterranean, where, however, it is more or less modified by the grand polar type. In the American type the single maximum of January rapidly gives way to a strongly marked depression in April, its recovery to the January maximum being slow but substantially uninterrupted.

The third type is called the Asiatic, and, like the American, consists of a single annual wave. The crest covers India and the valley of the Yenisei in December, but it is not simultaneous for all Asia, as the wave moves eastward, reaching the Pacific coast and the extreme southeastern part of Asia in February. The minimum pressure of the Asiatic type obtains in July for the greater part of that continent, although in Southern India it prevails a month earlier.

The observations at Honolulu, Hawaii, in connection with those of the Aleutian Archipelago, seem to indicate a fourth type. In this type, also a single wave, the May maximum wanes steadily to a January minimum over those portions of the North Pacific Ocean where it is not complicated by the advance of the Asiatic wave eastward in February. While the maximum of the Atlantic occurs generally in July, as over part of the Pacific, yet its maximum in middle latitudes, as shown by Bermuda and Delgada, obtains in April as in the United States, and the influence of the polar secondary wave appears at both stations in the tendency to a secondary curve with minimum in October and maximum in February.

While the movements of the atmospheric pressure from month to month, as here outlined, appear to be borne out by the international simultaneous observations for the past ten years, yet it must be admitted that more observations, especially in lower latitudes and over the Pacific Ocean, are necessary to determine how far these changes are regular and periodic.

STORM FREQUENCY IN THE NORTHERN HEMISPHERE.

The accompanying chart, No. 25, shows the storm frequency of the northern hemisphere as deducted from the international simultaneous observations. The reproduction of the storm tracts as published in the monthly charts, put forth under the direction of the Chief Signal Officer of the Army, would simply place before the student a mass of confused and often indeterminate lines, which would leave everything wanting on the score of clearness—a literary quality quite essential in graphic meteorology. It occurred to the Chief Signal Officer that the clearest method would be to enter in each five-degree square the entire number of storms whose centers had passed through the respective squares. Only the annual map is reproduced, but from the accompanying data can be readily constructed the maps for the separate months. The charts for the months of greatest and least storm frequency (August and December, respectively) have been published elsewhere. It must not be understood that these maps represent with absolute accuracy the presence and passage of all storms which have occurred during the years in question. Many storms doubtless have escaped observation, especially in the equatorial regions of the Atlantic and over such parts of the Pacific as are remote from the steamer routes or the coasts of Asia and America.

Again, there have been many storms of such slight intensity or of such brief duration as prevented their courses from being determined from the daily international observations on which these charts rest as a basis, It should also be borne in mind that in the early years of the international scheme the stations, especially the important moving stations on shipboard, reporting for this purpose, were few in number, and sometimes observations were had from such unreliable instruments as made their reports unsafe authority for storm charting. Despite these defects, which are recognized and deplored as fully in the Signal Office as elsewhere, these charts have a value which render them worthy of reproduction at this time when the United States Army, relieved from its official connection with this work, finds it necessary to sum up the results of its efforts in the interest of international meteorology.

The following persons have been actively connected with the preparation and discussion of the detailed storm charts, on which depend the accuracy and completeness of the annual chart herewith presented: Maj. H. H. C. Dunwoody, Signal Corps; Capt. John P. Story, Fourth Artillery; Capt. Robert Craig, Signal Corps; Prof. Cleveland Abbe; First Lieut. J. P. Finley, Nineteenth Infantry (formerly sergeant, Signal Corps); Mr. J. P. Walton (formerly sergeant, Signal Corps); Mr. E. B. Garriott (formerly sergeant, Signal Corps); and the present Chief Signal Officer while serving as a subaltern.

During the years 1878-1885, inclusive, on the basis of unity or represented by the existence of a storm in a five-degree square, storm conditions occurred 42,719 times over the northern hemisphere. Through the year the distribution by months was as follows:

January	3,997	April	3,675	July	2,823	October	3,778
February	3,589	May	3,340	August	2,925	November	3,902
March	4,199	June	2,780	September	3,437	December	4,274

The distribution in the two great ocean regions (Atlantic from the one hundred and twentieth parallel west, eastward to sixtieth parrallel east, and Pacific from sixtieth parallel east to two hundred and fortieth parallel east of Greenwich) is as follows:

Months.	Atlantic storms.	Pacific storms.
January	3,389	608
February	3,055	534
March	3,451	748
April	2,753	922
May	2,489	851
June	2,206	574
July	2,224	599
August	2,324	601
September	2,675	762
October	3,005	773
November	3,170	732
December	3,564	710

Taking the Northern Hemisphere as a whole, there is a gradual and unbroken increase in storm frequency from the minimum (considering the unequal number of days in the separate months) in July to the maximum in December. Thenceforward, except an increase in March, the decrease is regular to the July minimum. In other words, the great number of Atlantic storms cause its type of annual distribution to dominate, its fluctuations being as above.

In the Pacific region it is to be noted, however, that an entirely different type prevails, with two maxima and minima. The principal minimum of February gives way rapidly to the principal maximum in April, followed with uninterrupted regularity by the secondary minimum in June and maximum in September.

A notable point in connection with storm conditions is the high percentage of frequency in the vicinity of great bodies of water partly inclosed, such as the Davis Straits, Hudson Bay, the Gulf of Mexico, and the Great Lakes of North America, the Baltic Sea, North Sea, Mediterranean and Black seas in Europe, the Caspian Sea, China Sea, and Sea of Kamshatka in Asia, and also Bering Sea and Indian Ocean. The only important exception of frequent storm development and prevalence, apart from contiguous land and water areas, is found in North America, along the eastern slope of the Rocky Mountain range from Texas to Saskatchewan, and it is more than probable that these conditions arise from the contribution of aqueous vapor from Hudson Bay to the north, the Great Lakes to the east, and the Gulf of Mexico to the south.

In connection with the distribution of storm frequency with reference to the question of latitude, it occurred to the Chief Signal Officer as possible that the relative mean latitudes of storm tracks in the different months might in a measure depend upon the position of the sun, and that storms during winter might occur in a lower latitude and summer storms in a higher latitude than the average. With a view of elucidating this point there was selected for detailed examination the months of December and August as being respectively the months of greatest and approximately least storm frequency in the Northern Hemisphere, and as representing the seasons during which the sun's position reaches the great and least declination. In August for eight years there were 2,698 storm cases and in December 3,833. A detailed examination shows that in August there were 674 cases, or 25 per cent of all storm conditions south of the forty-fifth parallel, while in December there were 1,066 cases, or 28 per cent of all.

At the time of this writing the detailed storm data for the month of least frequency (July) were not accessible to the Chief Signal Officer, so that it is possible the southward drift is more pronounced in June or July than it appears to be in August.

In any event, the above-detailed data for December in comparison with that for August does not show a great amount of southing for winter storms. It may, however, be considered that the southward movement of winter storms with the sun is more decided than appears at first thought, especially if the question is treated with reference to storms north of the thirtieth parallel, thus excluding the hurricanes of the West Indies, which constitute more than 3 per cent of all August storms as against less than 1 per cent in the same latitudes during December.

With a view of separating the Pacific and Atlantic storms, which occur under somewhat different conditions as regards distribution of land and water, their frequency has been calculated. In so doing the Pacific region includes areas between the sixtieth and two hundred and fortieth meridians east of Greenwich, to the eastward, while the rest of the Northern Hemisphere is assigned to the Atlantic.

The following table shows, for each 5° of latitude from the equator to the eightieth parallel, the storm frequency for August, December, and the year over the Northern Hemisphere, and also over the Pacific and Atlantic areas as bounded above, with the respective percentages pertaining to each 5° of latitude:

North latitude		August.				December.				Year.	
		Atlantic.		Pacific.		Atlantic.		Pacific.			
From—	To—	No.	Per ct.	No.	Per ct.	No.	Per ct.	No.	Per ct.	No.	P. ct.
°	°										
0	5	0	0	0	0	0	0	0	0	0	0
5	10	0	0	0	0	0	0	3	1	16	0
10	15	11	1	3	1	3	0	5	1	114	0
15	20	17	1	21	4	1	0	6	1	217	1
20	25	21	1	20	4	5	0	3	1	311	1
25	30	33	2	34	6	37	1	10	2	686	2
30	35	41	2	35	6	114	4	27	4	1,663	4
35	40	81	4	81	15	252	8	75	12	3,595	8
40	45	217	10	60	11	452	14	74	12	5,814	14
45	50	480	22	50	9	643	20	102	15	8,557	20
50	55	395	18	79	14	506	15	111	18	6,816	16
55	60	376	18	114	21	392	12	152	25	5,716	14
60	65	266	12	38	7	378	12	37	6	4,364	10
65	70	166	8	15	3	350	11	1	0	3,358	8
70	75	44	2	0	0	95	3	0	0	901	2
75	80	0	0	0	0	0	0	0	0	2	0

The frequency of storm conditions increases from the tenth parallel, between which and the equator storms are practically unknown, to the regions situated between 45° and 50° north, whence the decrease northward is steadily maintained, but at a less rapid rate. More than 20 per cent of storm conditions occur between 40° and 60° north, and 64 per cent, or nearly two-thirds, between 40° and 60° north. Less than 1 per cent is noted north of 75°, this small number being probably due to lack of observations in such high latitudes.

It is, of course, to be borne in mind that the area of 5° squares diminishes materially with increased latitude, so that the two storms having tracks of equal length and moving in similiar compass courses, one in a high latitude may pass through twice as many squares as the second near the equator. It is a well known fact, however, that storms are much more frequent between 40° and 60° north latitude than between other parallels, so that it has not been thought advisable to attempt corrections for disproportionate areas.

It will be noticed that only 16 per cent of the August Atlantic storms occurred between the thirtieth and forty-fifth parallels, while in December no less than 26 per cent are there recorded. Similarly, of the Atlantic storms north of the fiftieth parallel there were 58 per cent in August and 53 per cent in December. These figures indicate a southerly drift of the Atlantic storms during the winter months, but the question is left somewhat indeterminate by the percentages for the Pacific region, which indicates a slight movement northward of storm frequency in December. Possibly, however, this movement may be rather seeming than real, as the Pacific storms are so few that an unusual number of storms of abnormal path in a single December or August would affect seriously the percentages.

The infrequency of storms south of the tenth parallel is a notable fact, fully confirmed by these observations, and in connection with the heavy rainfalls and large absolute humidity characteristic of the equatorial region indicates clearly that the existence alone of these latter conditions is insufficient for the development of storms.

Among the storms here recorded near the equator may be mentioned those developing to the eastward of or in the Caribbean Sea region: September 1, 1878, about 10° N., 60° W.; May 25, 1879, about 11° N., 75° W.; and August 13th and 16th, 1886, two storms, one on the 13th, about 14° N., 64° W., and the other on the 16th, about 13° N, 61° W.

Near the Philippines may be recalled those of July 13, 1880, about 8° N., 120° E.; November 14, 1880, about 8° N., 104° E.: November, 1881, two storms, one on the 7th, about 9° N., 125° E., and one on the 26th, about 8° N., 127° E.; and that of December 17th, 1886, about 9° N., 126° E.

The following tables indicate first the number of storms noted during the year and in each month for every 5° of longitude: and, second, the decreases and increases from month to month:

TABLE SHOWING NUMBER OF STORMS OBSERVED ON DIFFERENT MERIDIANS.

Longitude.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
2 E...	85	71	97	76	87	73	79	68	90	89	100	114
7 E...	86	66	97	89	86	70	70	79	78	106	110	119
12 E...	115	84	112	88	91	81	73	88	78	108	112	131
17 E...	111	90	109	103	86	77	70	75	67	111	111	122
22 E...	104	84	116	87	88	88	84	74	64	97	94	147
27 E...	95	77	108	88	85	68	70	66	58	84	85	110
32 E...	99	78	102	80	76	58	66	60	57	83	78	100
37 E...	87	71	100	63	68	54	57	54	63	72	78	81
42 E...	68	60	65	50	62	56	44	45	42	59	72	69
47 E...	56	50	60	48	57	41	33	42	42	46	56	57
52 E...	44	38	46	40	32	30	24	36	40	41	42	50
57 E...	38	32	39	37	30	22	20	29	30	35	32	35
62 E...	22	27	29	36	22	15	18	25	23	33	25	21
67 E...	16	25	25	27	24	16	22	22	23	21	22	16
72 E...	11	13	18	20	24	18	25	16	21	23	17	15
77 E...	9	12	12	22	22	15	26	19	21	25	19	13
82 E...	8	12	10	10	21	20	30	21	27	29	27	18
87 E...	6	6	8	20	22	22	35	30	31	22	20	10
92 E...	4	8	9	18	18	4	9	10	13	17	17	8
97 E...	3	5	6	11	10	3	3	2	4	8	8	7
102 E...	1	2	4	10	17	2	3	2	2	8	7	5
107 E...	1	2	2	6	19	4	17	8	6	19	10	1
112 E...	4	6	7	23	30	22	19	12	16	23	12	3
117 E...	4	9	14	40	33	37	38	32	26	25	22	11
122 E...	8	9	21	46	46	40	49	57	55	25	30	13
127 E...	16	12	32	47	59	44	40	52	58	23	27	15
132 E...	24	25	41	60	55	47	33	46	56	41	34	19
137 E...	29	35	50	68	63	38	32	41	54	40	39	48
142 E...	41	37	70	70	56	36	24	30	44	50	59	75
147 E...	41	38	57	42	39	18	19	18	27	25	42	49
152 E...	24	24	29	21	18	11	7	12	19	17	27	28
157 E...	17	13	19	15	12	9	7	9	11	11	12	17
162 E...	17	11	14	15	15	8	11	10	12	10	11	14
167 E...	15	9	13	12	11	12	11	11	16	9	8	9
172 E...	13	8	13	12	15	9	11	6	15	12	8	12
177 E...	14	5	14	16	10	9	11	10	13	14	11	17
177 W...	23	8	19	21	15	10	13	12	23	17	10	17
172 W...	24	12	24	18	16	16	19	13	23	19	15	11
167 W...	28	9	19	33	22	14	16	16	22	24	15	14
162 W...	20	11	15	17	19	14	17	14	22	26	18	15
157 W...	12	9	15	10	14	11	7	10	12	21	16	13
152 W...	16	16	11	12	10	10	4	4	12	18	17	9
147 W...	12	11	5	12	8	5	4	4	8	14	17	11
142 W...	12	11	5	17	8	4	2	4	10	16	19	11
137 W...	13	14	10	21	15	4	2	5	9	17	21	17
132 W...	20	21	21	26	18	4	2	5	8	19	21	22
127 W...	38	24	39	34	20	6	5	5	8	23	25	41
122 W...	47	35	48	35	25	17	8	8	12	29	24	35
117 W...	57	49	50	41	31	33	10	9	27	39	30	49
112 W...	70	57	64	60	34	46	28	19	32	55	40	49
107 W...	84	64	80	68	50	56	56	38	49	65	52	70

TABLE SHOWING NUMBER OF STORMS OBSERVED, ETC.—Continued.

Longitude.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sep.	Oct.	Nov.	Dec.
102 W..	89	85	110	103	95	67	91	63	73	88	83	96
97 W..	127	118	128	99	107	75	96	80	101	108	128	102
92 W..	141	112	137	96	89	68	82	85	107	99	116	123
87 W..	130	107	119	91	94	77	83	87	116	110	120	127
82 W..	129	103	116	81	77	59	76	84	86	105	107	117
77 W..	120	110	115	84	87	60	84	96	98	105	109	131
72 W..	117	114	114	72	89	63	88	94	96	101	116	124
67 W..	129	113	120	83	97	70	94	93	102	101	124	116
62 W..	118	109	119	71	82	69	78	88	81	91	115	118
57 W..	102	118	106	87	68	77	78	80	101	97	106	113
52 W..	96	104	99	82	67	81	77	72	101	111	92	120
47 W..	103	86	98	82	50	72	65	51	85	112	79	103
42 W..	93	99	96	83	47	51	47	43	56	87	67	91
37 W..	97	109	103	81	51	59	45	56	73	82	73	106
32 W..	97	95	104	69	53	56	43	64	95	79	72	98
27 W..	96	90	88	78	53	61	46	66	84	81	96	105
22 W..	82	83	86	66	50	61	44	60	80	71	88	97
17 W..	78	79	86	73	52	53	49	65	82	66	73	88
12 W..	80	76	86	82	54	53	57	69	81	70	82	87
7 W..	87	89	88	94	79	56	60	80	84	72	97	95
2 W..	85	85	88	78	85	65	57	66	76	79	85	104

TABLE SHOWING CHANGE IN NUMBER OF STORMS ON EVERY FIFTH MERIDIAN FROM MONTH TO MONTH.

Longitude.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sep.	Oct.	Nov.	Dec.
2 E	29	14	-26	21	-11	14	-6	11	-22	1	-11	-14
7 E	33	20	-31	8	3	16	00	9	1	-28	-4	-9
12 E	16	31	-28	24	-3	10	8	-15	10	-30	-4	-19
17 E	11	21	-19	6	17	9	7	-5	8	-44	00	-11
22 E	43	20	-32	29	-1	00	4	10	10	-33	3	-53
27 E	15	18	-31	20	3	17	-2	4	8	-26	-1	-25
32 E	1	21	-24	22	4	18	-8	6	3	-26	5	-22
37 E	-6	16	-29	37	-5	14	-3	3	-9	-9	-6	-3
42 E	1	8	-5	15	-12	6	12	-1	3	-17	-13	3
47 E	1	6	-10	12	-9	16	8	-9	00	-4	-10	-1
52 E	6	6	-8	6	8	2	6	-12	-4	-1	-1	-8
57 E	-3	6	-7	2	7	8	2	-9	-1	-5	3	-3
62 E	-1	-5	-2	-7	14	7	-3	-7	2	-10	8	4
67 E	00	-9	00	-2	3	8	-6	00	-1	2	-1	6
72 E	4	-2	-5	-2	-4	6	-7	9	-5	-2	6	2
77 E	4	-3	00	-10	00	7	-11	7	-2	-4	6	6
82 E	10	-4	2	-9	-2	1	-10	9	-6	-2	2	9
87 E	4	00	-2	-12	-2	00	-13	5	-1	9	2	10
92 E	4	-4	-1	-9	00	14	-5	-1	-3	-4	00	9
97 E	4	-2	-1	-5	1	7	00	1	-2	-4	00	1
102 E	4	-1	-2	-6	-7	15	-1	1	00	-6	1	2
107 E	00	-1	00	-4	-13	15	-13	9	2	-13	9	9
112 E	-1	-2	-1	-16	-7	8	3	7	-4	-7	11	9
117 E	7	-5	-5	-26	7	-4	-1	6	6	1	3	11
122 E	5	-1	-12	-25	00	6	-9	-8	2	30	-5	17
127 E	-1	4	-20	-15	-12	15	4	-12	-6	35	-4	12
132 E	-5	-1	-16	-19	5	8	14	-13	-10	15	7	15
137 E	19	-6	-15	-18	5	25	6	-9	-13	14	1	-9
142 E	34	4	-33	00	14	20	12	-6	-14	-6	-9	-16
147 E	8	3	-19	15	3	21	-1	1	-9	2	-17	-7
152 E	4	00	-5	8	3	7	4	-5	-7	2	-10	-1
157 E	00	4	-6	4	3	3	2	-2	-2	00	-1	-5
162 E	-3	6	-3	-1	00	7	-3	1	-2	2	-1	-3
167 E	-6	6	-4	1	1	-1	1	00	-5	7	1	-1
172 E	-1	5	-5	1	-3	6	-2	5	-9	3	4	-4
177 E	3	9	-9	-2	6	1	-2	1	-3	-1	3	-6
178 W	-6	15	-11	-2	6	5	-3	1	-11	6	7	-7
173 W	-13	12	-12	6	2	00	-3	6	-10	4	4	4
168 W	-9	14	-10	-4	1	8	-2	00	-6	-2	9	1
163 W	-5	9	-4	-2	-2	5	-3	3	-8	-4	8	3
158 W	1	3	-6	5	-4	3	4	-3	-2	-9	5	3
153 W	-7	00	5	-1	2	00	6	00	-8	-6	1	8
148 W	-1	1	6	-7	4	3	1	00	-4	-6	-3	6
143 W	-1	1	6	-12	9	4	2	-2	-6	-6	-3	8
138 W	4	-1	4	-11	6	11	2	-3	-4	-8	-4	4
133 W	2	-1	00	-5	8	14	2	-3	-3	-11	-2	-1
128 W	3	14	-15	5	14	14	1	00	-3	-15	-2	-16
123 W	-12	12	-13	13	10	8	9	00	-4	-17	5	-11
118 W	-8	8	-1	9	10	-2	23	1	-18	-12	9	-19
113 W	-21	23	-7	4	16	-12	18	9	-13	-23	15	-9
108 W	-14	20	-16	12	18	-6	00	18	-11	-16	13	-18

TABLE SHOWING CHANGE IN NUMBER OF STORMS, ETC.—Continued.

Longitude.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sep.	Oct.	Nov.	Dec.
103 W..	7	4	—25	7	8	28	—24	28	—10	—15	5	—13
98 W..	—25	9	—10	29	— 8	32	—21	16	—21	— 7	—20	—26
93 W..	—18	29	—25	41	7	21	—14	— 3	—22	8	—17	— 7
88 W..	— 3	23	—12	28	— 3	17	— 6	— 4	—29	6	—10	— 7
83 W..	—12	26	—13	35	4	18	—17	— 8	— 2	—19	— 2	—10
78 W..	11	10	— 5	31	— 3	27	—24	—12	— 2	— 7	— 4	—22
73 W..	7	3	00	42	—17	26	—25	— 6	— 2	— 5	—15	— 8
68 W..	—13	16	— 7	37	—14	27	—24	— 1	— 9	1	—23	8
63 W..	00	9	—10	48	—11	13	— 9	—10	7	—10	—24	3
58 W..	11	—16	12	19	19	— 9	— 1	— 2	—21	4	— 9	— 7
53 W..	24	— 8	5	17	15	—14	4	5	—29	—10	19	—28
48 W..	00	17	—12	16	32	—22	7	14	—34	—27	33	—24
43 W..	— 2	— 6	3	13	36	— 4	4	4	—13	—31	20	—24
38 W..	9	—12	6	22	30	— 8	14	—11	—17	— 9	9	—33
33 W..	1	2	— 9	35	16	— 3	13	—21	—31	16	7	—26
28 W..	9	6	2	10	25	— 8	15	—20	—18	3	—15	— 9
23 W..	15	— 1	— 3	20	16	—11	17	—16	—20	9	—17	— 9
18 W..	10	— 1	— 7	13	21	— 1	4	—16	—17	16	— 7	—15
13 W..	7	4	—10	4	28	1	— 4	—12	—12	11	—12	— 5
8 W..	8	— 2	1	— 6	15	23	— 4	—20	— 4	12	—25	2
3 W..	19	00	— 3	10	— 7	20	8	— 9	—10	— 3	— 6	—19

With reference to longitude, least frequency of storm conditions obtains between the ninety-fifth and one hundred and fifth meridians east of Greenwich, over the interior of Asia, where the principal minimum is found. Thence going eastward, the storm frequency increases steadily for each 5° of longitude to the vicinity of the island of Japan, from 135° to 145° east, where the third maximum is situated. Further eastward, except a slight interruption in the Bering Sea region, the frequency of storm conditions decrease to a secondary minimum, between 210° to 220° east of Greenwich, in the longitude of southeastern Alaska. From these meridians there is a very rapid increase eastward to the regions between 260° and 280° east of Greenwich, from Manitoba to the region of the Great American Lakes, where is located the principal maximum of storm frequency in the Northern Hemisphere. In these 20° of longitude no less than 12 per cent of all the storms occur, and in the vicinity between the fortieth and fiftieth parallels of north latitude and the sixtieth and one hundredth meridians of west longitude no less than 14 per cent of storm conditions occur.

From Newfoundland eastward over the Atlantic the storm frequency slightly decreases to a third minimum between the fortieth and forty-fifth meridians west of Greenwich, south of Greenland. An increase follows eastward to the secondary maximum, between the tenth and twenty-fifth meridians east of Greenwich, comprising the Mediterranean and Baltic seas and the northern part of Norway.

The storm frequency relative to distribution by mean longitude has been calculated for each month, with the following results:

PACIFIC REGION FROM SIXTIETH TO TWO HUNDRED AND FORTIETH MERIDIAN EAST OF GREENWICH.

Month.	Mean longitude.
January	165.7 E.
February	153.8 E.
March	151.3 E.
April	145.1 E.
May	138.6 E.
June	138.0 E.
July	129.3 E.
August	132.3 E.
September	139.1 E.
October	146.3 E.
November	145.4 E.
December	148.2 E.

There appears to be a steady and unbroken westerly movement from January, the month of greatest easting, to July, the month of greatest westing, after which a reverse movement sets in.

There is, however, apparently no such regular change in the mean monthly longitude of Atlantic storms from 120 west eastward to 60 east, as is shown by the following data:

Month.	Mean longitude.
January	35.5 W.
February	35.5 W.
March	35.5 W.
April	33.2 W.
May	30.6 W.
June	32.0 W.
July	35.3
August	32.1 W.
September	35.9
October	34.3 W.
November	33.9 W.
December	34.7 W.

The following table shows in detail barometric data used in the preparation of the accompanying charts, etc., from selected stations whereat international simultaneous observations have been regularly taken from 1878 to 1887, inclusive, and at other isolated points without the international network:

Stations.	Lat.	Long.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Algerian:	° ′	° ′												
Algiers	36 47 N.	3 05 E.	30.18	30.14	30.03	29.97	29.96	30.02	30.00	29.98	30.00	30.04	30.08	30.12
Biskra	34 51 N.	5 41 E.	.22	.20	.07	.98	.95	.03	.03	30.02	.02	.09	.15	.18
Geriville	33 53 N.	1 40 E.	------	------	------	30.02	30.01	.04	.04	.10	.05	.07	9.96	.01
LaCalle	36 54 N.	8 26 E.	.16	.13	.02	29.91	29.97	.04	.01	29.99	29.98	.04	0.08	.09
Laghouat	33 48 N.	2 53 E.	.25	.23	.11	30.00	30.00	.04	.02	30.03	30.05	.12	.18	.18
Mogador	31 30 N.	9 48 W.	.21	.19	.12	.10	.05	------	.02	.02	.09	.08	.10	.23
Nemours	35 06 N.	1 50 W.	.21	.17	.05	29.98	29.98	.02	.02	29.99	29.99	.05	.11	.16
Saida	34 51 N.	0 10 E.	.19	.18	.09	30.01	30.00	.06	.03	30.02	30.03	.07	.13	.13
Tebessa	35 24 N.	8 06 E.	.19	.19	.10	29.99	30.00	.04	.05	.02	.01	.09	------	.14
Tunis	36 42 N.	10 13 E.	.14	.13	.02	.92	29.98	.02	.00	.00	29.98	.05	.10	.05
Austrian:														
Agram	45 48 N.	15 53 E.	30.17	30.17	30.02	29.86	29.94	29.94	29.96	29.95	30.01	30.01	30.07	30.08
Cracow	50 04 N.	20 00 E.	.15	.16	.01	.90	.94	.91	.93	.93	.00	29.99	.03	.02
Eperies	48 58 N.	21 15 E.	.15	.14	29.98	.86	.91	.88	.89	.90	29.99	30.00	.06	.01
Gratz	47 04 N.	15 28 E.	.16	.12	.99	.86	.93	.95	.94	.93	.98	29.99	.05	.05
Hermanstadt	45 47 N.	24 13 E.	.18	.11	.93	.87	.88	.85	.85	.86	.98	.97	.07	.06
Kremsmunster	48 03 N.	14 08 E.	.15	.12	30.00	.83	.92	.92	.94	.93	.98	.98	.04	.03
Lemberg	49 50 N.	24 00 E.	.14	.14	29.97	.91	.94	.90	.92	.92	.99	30.04	.07	.03
Pola	44 52 N.	13 51 E.	.08	.09	.99	.85	.95	.94	.97	.93	.98	29.98	.00	.00
Zathmar	47 46 N.	22 53 E.	.15	.14	.93	.85	.90	.86	.89	.91	.98	30.00	.05	.05
Zegedin	46 15 N.	20 10 E.	.14	.13	.99	.84	.90	.89	.89	.91	.97	29.98	.05	.03
Trieste	45 39 N.	13 46 E.	.13	.10	.98	.87	.96	.94	.96	.94	.98	.97	.01	.00
Vienna	48 12 N.	16 22 E.	.15	.13	30.00	.86	.94	.93	.96	.94	30.01	30.00	.04	.05
British:														
Aberdeen	57 10 N.	2 06 W.	29.89	29.83	29.90	29.89	29.92	29.93	29.84	29.85	29.88	29.82	29.77	29.74
Armaugh	54 21 N.	6 39 W.	30.03	.84	.96	.84	.98	.87	.86	.86	.89	.91	.83	.91
Bidston	53 24 N.	3 04 W.	29.99	.91	.97	.88	.96	.94	.90	.87	.90	.91	.86	.85
Bradford	53 48 N.	1 47 W.	.96	.91	.96	.85	.92	.94	.89	.88	.90	.89	.85	.89
Bridgetown	13 04 N.	59 37 W.	0.01	0.00	0.00	0.06	.99	0.02	0.02	.98	.96	.95	.95	.99
Chatham	51 25 N.	0 33 E.	.05	.00	.02	9.88	.99	9.99	9.97	.94	.99	.94	.93	.97
Falmouth	50 09 N.	5 04 W.	.04	9.98	.03	.87	0.01	0.00	0.01	.98	.98	.91	.92	.98
Freetown	8 30 S.	13 14 W.	9.88	.85	9.88	.87	9.87	9.88	9.91	.92	.87	.86	.87	.88
Galway	53 15 N.	9 03 W.	.85	.75	.91	.83	.88	.93	.89	.86	.87	.89	.85	.88
Gibraltar	36 09 N.	5 21 W.	0.15	0.17	0.05	.99	0.01	0.05	0.00	0.00	0.00	0.04	0.09	0.12

Glasgow	55	53 N.	4	17 W.	9.99	9.79	9.86	.82	9.87	9.82	9.82	9.87	9.88	9.83	9.83	9.80
Greenwich	51	29 N.	0	0 W.	0.04	.98	0.02	.87	.98	.99	.95	.93	.95	.92	.91	.94
Guernsey	49	27 N.	2	41 W.	.06	0.01	.03	.87	0.00	0.00	0.00	.97	.98	.97	.94	.98
Kew	51	28 N.	0	19 W.	.04	.99	.02	.87	9.97	9.97	9.94	.93	.96	.92	.91	.94
Leicester	52	39 N.	1	08 W.	.02	.96	.00	.87	.96	.97	.92	.90	.94	.92	.90	.91
Malta	36	00 N.	14	30 E.	.02	0.06	9.95	.87	.97	.97	.97	.94	.96	0.01	0.02	0.01
Nassau	25	04 N.	77	22 W.	.15	.14	0.11	0.06	0.04	0.06	0.08	0.02	0.00	9.99	.08	.13
Oxford	51	46 N.	1	17 W.	.04	9.97	.02	9.88	9.97	9.94	9.95	9.94	9.94	.95	9.93	9.95
Plymouth	50	22 N.	4	10 W.	.02	.97	.01	.85	.98	0.00	.98	.96	.96	.93	.92	.98
Scutari	41	00 N.	29	03 E.	.08	0.08	9.96	.88	.88	9.85	.82	.84	.91	0.02	0.04	0.00
Swanbister	58	55 N.	3	05 W.	9.81	9.75	.82	.84	.90	.91	.80	.82	.81	.82	9.72	9.68
Valentia	51	55 N.	10	18 W.	.94	.86	.98	.84	.97	.98	.94	.93	.92	.94	.90	.94
Canadian:																
Chatham	47	03 N.	65	59 W.	29.98	30.00	29.91	29.91	29.99	29.91	29.89	29.94	30.04	30.05	29.95	29.98
Father Point	48	34 N.	68	28 W.	.99	.02	.90	.90	.97	.86	.85	.91	.00	.00	.94	.98
Fort Garry	49	51 N.	97	07 W.	30.17	.17	30.11	30.02	.96	.90	.91	.93	9.95	9.99	0.07	0.17
Halifax	44	39 N.	63	36 W.	.00	.01	29.90	29.90	0.01	.96	.95	.98	0.05	30.07	.01	.03
Kingston	44	14 N.	76	30 W.	.08	.08	.99	.97	9.98	.96	.93	.99	.06	.08	.03	.06
Montreal	45	31 N.	73	33 W.	.00	.04	.97	.94	.96	.92	.91	.96	.05	.05	.02	.04
Parry Sound	45	19 N.	80	01 W.	.05	.08	30.02	.98	.98	.95	.93	.98	.05	.06	.00	.03
Port Dover	42	47 N.	80	13 W.	08	.10	.02	.99	.99	.97	.96	30.00	.07	.08	.08	.07
Port Stanley	42	40 N.	81	13 W.	.09	.08	.02	.99	.98	.96	.96	.00	.06	.07	.07	.07
Quebec	46	48 N.	71	12 W.	.04	.05	9.95	.92	.98	.90	.89	9.94	.02	.05	9.98	.06
Rockliffe	46	10 N.	77	48 W.	.07	.08	0.03	.99	.98	.94	.92	.97	.06	.06	0.00	.02
St. Andrews	45	04 N.	67	06 W.	9.99	.00	9.88	.89	.97	.94	.91	.94	.07	.06	9.95	9.98
St. Pierre	46	30 N.	72	10 W.	.89	9.91	.77	.93	.97	.91	.92	.93	9.96	9.97	.85	.86
Saugeen	44	30 N.	81	21 W.	0.05	0.06	0.02	.99	.97	.95	.95	.98	0.06	0.05	0.00	0.01
Sidney	46	08 N.	60	10 W.	9.92	9.94	9.86	.86	.98	.92	.90	.94	.04	.00	9.94	9.92
Toronto	43	39 N.	79	23 W.	0.09	0.10	0.02	0.00	0.00	.98	.96	0.01	.08	.12	0.06	0.06
Yarmouth	43	50 N.	66	02 W.	.06	.02	9.86	9.90	9.99	.95	.93	9.99	.07	.07	0.02	.00
York Factory	57	00 N.	93	00 W.	.03	.11	0.18	0.09	0.04	.97	.85	.89	9.97	9.96	.02	.03
Moose Factory	51	00 N.	81	00 W.	9.97	.04	-------	9.95	9.98	.97	.89	.94	-------	.91	9.97	.00
Fort Rae	62	39 N.	115	44 W.	0.47	.42	.47	0.20	0.25	.99	.99	0.01	0.04	0.00	0.19	.31
Minnedosa	50	13 N.	99	48 W.	.22	.24	.12	9.98	9.91	.89	.90	9.93	9.89	.00	.05	.17
Qu'Appelle	50	44 N.	103	42 W.	.24	.23	.10	0.01	9.88	.89	.91	.85	.96	.03	.04	.19
Medicine Hat	50	01 N.	110	37 W.	.18	.18	.04	9.95	.87	.81	.86	.88	.90	.95	.00	.17
Calgary	51	00 N.	114	05 W.	-------	-------	-------	.95	.95	.97	.93	-------	.93	-------	-------	.20
Edmonston	54	00 N.	113	00 W.	30.34	.22	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
St. John, N. F.	47	00 N.	53	00 W.	29.82	9.90	9.81	9.87	0.06	0.00	0.04	0.01	0.08	0.10	0.05	9.91

Stations.	Lat.	Long.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	° ′	° ′												
Chinese:														
Zi-Ka-Wei	31 12 N.	121 26 E.	30.37	30.33	30.22	30.10	29.90	29.78	29.73	29.77	29.94	30.14	30.29	30.35
Danish:														
Copenhagen	55 41 N.	12 36 E.	29.99	30.00	29.93	29.92	29.93	29.90	29.86	29.85	29.92	29.92	29.86	29.79
Fanoe	55 27 N.	8 24 E.	.99	9.98	.94	.90	.94	.91	.88	.87	.90	.85	.84	.80
Godthaab	64 11 N.	51 46 W.	.50	.57	.66	.80	.88	.76	.80	.75	.67	.68	.67	.57
Stykkisholm	65 05 N.	22 46 W.	.30	.46	.63	.75	.81	.73	.70	.69	.62	.55	.60	.39
Thorshaven	62 02 N.	6 44 W.	.67	.63	.78	.87	.87	.88	.82	.79	.74	.81	.65	.61
Vestervig	56 47 N.	8 20 E.	.93	.94	.90	.90	.90	.87	.82	.83	.86	.86	.82	.73
French:														
Agen	44 12 N.	0 38 E.	30.13	30.16	30.03	29.93	30.05	30.06	30.09	30.05	30.07	30.11	30.08	30.14
Alençon	48 20 N.	0 05 E.	.10	.00	.03	.88	29.99	.01	.02	29.98	.01	29.99	29.98	.05
Avignon	43 57 N.	4 49 E.	.09	.09	0.00	.85	.96	9.98	0.00	.95	0.00	.99	.02	.06
Bar-sur-Seine	48 07 N.	4 22 E.	.13	.09	.03	.85	.99	0.00	.02	.98	.04	.98	0.00	.06
Besançon	47 13 N.	6 02 E.	.16	.10	.03	.90	.98	0.00	.02	0.00	.03	0.00	.03	.12
Bordeaux	44 50 N.	0 32 E.	.11	.09	.02	.87	0.00	0.00	.04	.03	.03	0.00	.03	.10
Brest	48 24 N.	4 30 W.	.07	.01	.03	.85	.01	.03	.03	9.98	.02	9.98	9.98	.04
Caen	49 11 N.	0 21 W.	.06	.02	.01	.83	9.96	9.98	.02	.96	9.94	.96	.97	.00
Chalons-sur-Marne	48 57 N.	4 21 E.	.12	.09	.02	.86	.96	.98	.01	.96	.99	.98	.99	.03
Clermont	45 46 N.	3 05 E.	.13	.08	.00	.83	.97	.98	0.00	.96	0.00	.98	.01	.08
Greasque	43 25 N.	5 37 E.	.08	.10	.00	.86	.96	.97	9.96	.96	.04	.98	.01	.04
Lorient	47 45 N.	3 21 W.	.10	.04	.05	.88	0.04	0.05	0.05	0.01	.00	.99	9.98	.05
Mans	48 00 N.	0 12 E.	.13	.10	.05	.86	.01	.02	.04	.01	.00	.99	0.00	.07
Marseille	43 18 N.	5 23 E.	.06	.06	.97	.83	9.96	0.00	.05	9.96	9.99	.97	9.99	.04
Perpignan	42 42 N.	2 53 E.	.10	.10	.02	.87	.99	.01	.02	.99	.01	0.00	.04	.09
Rochefort	45 56 N.	0 58 W.	.13	.09	.04	.88	30.00	30.04	30.06	30.02	30.04	30.00	30.02	.09
Roche-sur-Yon	46 40 N.	1 26 W.	.12	.08	.04	.87	.01	.01	.04	.01	.06	9.99	.02	.08
Rouen	49 26 N.	1 05 W.	.09	.05	.03	.86	.00	9.99	.01	9.98	9.99	.96	9.96	.01
St. Maur	48 48 N.	2 21 W.	.11	.08	.04	.86	.01	0.03	.04	0.02	0.01	0.00	.99	.05
Toulouse	43 37 N.	1 27 W.	.13	.10	.03	.88	.00	.04	.05	.01	.04	.02	0.03	.01
Versailles	48 48 N.	2 07 W.	.15	.02	.03	.84	.00	.00	.01	9.97	9.94	9.99	.92	.07
German:														
Bamberg	49 54 N.	10 54 E.	.13	.07	.02	.88	9.95	9.90	9.98	9.96	9.99	9.97	0.02	30.00
Berlin	52 30 N.	13 19 E.	.08	.07	9.99	.89	.96	.94	.94	.91	.95	.93	9.93	29.92
Breslau	51 07 N.	17 02 E.	.12	.12	0.01	.92	.97	93	.94	.94	0.00	.98	.99	.97

Carlsruhe	49	01 N.	8	25 E.	.16	.11	.03	.87	.98	.97	.99	.96	.00	0.00	0.01	0.04
Cassel	51	19 N.	9	28 E.	.09	.02	.01	.88	.96	.95	.96	.94	9.97	9.95	9.96	9.96
Frankfort	50	08 N.	8	41 E.	.15	.11	.05	.89	.99	.98	.99	.95	.97	.98	0.00	0.02
Friedrichshafen	47	39 N.	9	29 E.	.17	.13	.03	.85	.97	.97	.99	.96	0.01	0.00	.03	.06
Hamburg	53	33 N.	9	58 E.	.04	.04	9.98	.90	.96	.93	.92	.91	9.95	9.90	9.90	9.90
Kiel	54	19 N.	10	04 E.	.03	.01	.96	.91	.95	.93	.90	.89	.96	.89	.88	.84
Leipsig	51	20 N.	12	24 E.	.12	.09	0.03	.90	.97	.95	.97	.94	.99	.97	.99	.97
Memel	55	43 N.	21	07 E.	9.98	.06	9.95	.97	.96	.90	.90	.89	0.00	.93	.92	.85
Neufarhrwasser	54	24 N.	18	40 E.	0.06	.08	.97	.95	.98	.94	.92	.91	9.99	.94	.93	.88
Stuttgart	48	47 N.	9	11 E.	.12	.07	0.00	.86	.93	.95	.97	.94	.98	.96	.99	0.01
Wustrow	54	21 N.	12	24 E.	.04	.04	9.98	.93	.97	.93	.92	.90	.96	.92	.89	9.85
Greek:																
Athens	37	58 N.	23	44 E.	30.08	30.09	29.99	29.91	9.95	9.86	9.85	9.87	9.96	30.01	30.05	30.02
Indian:																
Agra	27	10 N.	78	05 E.	30.03	29.96	29.83	29.69	29.56	29.45	29.47	29.52	29.64	29.82	29.98	30.05
Allahabad	25	26 N.	81	52 E.	.03	.95	.82	.67	.57	.44	.47	.54	.65	.82	.97	.04
Belgaum	15	52 N.	74	42 E.	9.92	.86	.82	.75	.72	.73	.76	.78	.82	.84	.88	9.92
Bellary	15	09 N.	76	57 E.	.88	.83	.74	.68	.63	.64	.66	.68	.72	.81	.85	.87
Bombay	18	54 N.	72	49 E.	.95	.92	.87	.80	.76	.69	.69	.73	.79	.84	.90	.94
Calcutta	22	23 N.	88	21 E.	0.01	.94	.83	.71	.64	.53	.52	.58	.67	.81	.94	0.00
Chittagong	22	21 N.	91	50 E.	.00	.96	.89	.79	.72	.61	.61	.66	.77	.83	.92	9.99
Cuttack	20	29 N.	85	54 E.	.00	.93	.84	.73	.65	.54	.54	.59	.66	.83	.94	0.01
Deesa	24	16 N.	72	14 E.	9.99	.94	.84	.73	.61	.52	.50	.60	.69	.83	.96	.01
Dhubie	26	07 N.	89	50 E.	0.00	.92	.80	.70	.66	.55	.53	.59	.68	.81	.94	.02
Hazaribaugh	24	00 N.	85	24 E.	.02	.95	.82	.68	.57	.52	.51	.56	.66	.83	.97	.04
Jeypore	26	55 N.	75	50 E.	.02	.97	.83	.70	.57	.47	.47	.55	.67	.83	.98	.06
Jubbulpore	23	09 N.	79	59 E.	.02	.94	.82	.69	.57	.51	.53	.58	.67	.84	.98	.03
Kurrachee	24	47 N.	67	04 E.	.03	.99	.90	.79	.68	.54	.51	.59	.71	.78	.98	.04
Lahore	31	34 N.	74	20 E.	.06	.99	.85	.70	.56	.41	.43	.49	.63	.82	.99	.06
Lucknow	26	50 N.	81	00 E.	.03	.86	.83	.69	.58	.46	.47	.53	.65	.82	.98	.04
Nagpur	21	09 N.	79	11 E.	9.97	.89	.78	.67	.56	.54	.56	.60	.67	.83	.93	9.99
Patna	25	37 N.	85	08 E.	0.03	.95	.81	.67	.59	.49	.50	.55	.65	.83	.96	0.04
Poona	18	28 N.	74	10 E.	9.92	.86	.77	.72	.69	.67	.69	.74	.83	.83	.89	9.94
Roorkee	29	52 N.	77	56 E.	0.01	.96	.85	.69	.56	.42	.47	.52	.63	.87	.98	0.05
Sibsagar	26	59 N.	94	40 E.	.05	.98	.89	.80	.72	.59	.56	.61	.71	.80	.93	.04
Trichinopoly	10	50 N.	78	44 E.	9.99	.98	.94	.85	.80	.78	.80	.81	.83	.87	.93	9.98
Aden	12	45 N.	45	03 E.	0.06	0.00	.96	.88	.82	.72	.67	.69	.77	.92	0.00	0.05
Bushire	28	59 N.	50	49 E.	.13	.07	.98	.87	.75	.57	.48	.53	.70	.92	.05	.11
Silchar	24	49 N.	92	50 E.	.04	.00	.91	.82	.76	.64	.63	.68	.76	.88	.98	.03

Stations.	Lat.	Long.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Indian—Continued.	° ′	° ′												
Sironcha	18 51 N.	80 00 E.	.03	9.99	.90	.80	.71	.66	.69	.70	.76	.88	.98	.03
Amini Divi	11 06 N.	72 48 E.	------	------	------	------	.85	.83	.86	.87	.92	.90	.91	.95
Managalore	12 52 N.	74 54 E.	29.96	29.94	29.92	29.86	29.83	29.83	29.84	29.85	29.89	29.89	29.89	29.93
Madras	13 04 N.	80 14 E.	30.01	.99	.93	.84	.76	.72	.74	.77	.79	.86	.94	0.00
Cochin	9 58 N.	76 17 E.	29.94	.93	.91	.87	.85	.87	.88	.89	.91	.90	.91	9.93
Colombo	6 56 N.	79 52 E.	.92	.92	.91	.86	.85	.86	.87	.88	.90	.90	.90	.91
Jaffua	9 40 N.	79 56 E.	.98	.96	.92	.85	.79	.78	.78	.80	.83	.86	.90	.94
Batticaloa	7 43 N.	81 44 E.	.98	.97	.94	.87	.82	.81	.83	.83	.86	.88	.91	.94
Akyab	20 28 N.	92 57 E.	0.02	.97	.92	.85	.78	.70	.69	.73	.78	.87	.96	0.01
Thayetmyo	19 22 N.	95 12 E.	9.98	.92	.86	.77	.74	.71	.70	.72	.77	.86	.96	9.98
Diamond	15 52 N.	94 19 E.	0.01	.98	.94	.87	.82	.77	.77	.79	.83	.89	.93	.98
Rangoon	16 46 N.	96 12 E.	9.99	.95	.91	.84	.79	.77	.77	.79	.83	.88	.93	.98
Merqui	12 11 N.	98 38 E.	.96	.95	.92	.87	.84	.83	.83	.84	.87	.88	.90	.94
Port Blair	11 41 N.	92 42 E.	.96	.95	.93	.86	.81	.79	.80	.81	.84	.87	.90	.94
Nancowry	8 00 N.	93 46 E.	.94	.94	.92	.88	.85	.84	.85	.86	.88	.89	.90	.92
Penang	5 30 N.	101 00 E.	0.01	0.01	.98	.96	.87	.96	.96	.98	.99	.99	.98	.99
Malacca	2 10 N.	102 14 E.	9.89	9.89	.87	.88	.86	.86	.87	.87	.88	.87	.87	.89
Singapore	1 17 N.	103 51 E.	.95	.92	.91	.87	.87	.89	.88	.88	.89	.88	.89	.89
Italian:														
Cagliari	39 30 N.	9 00 E.	30.06	30.07	29.96	29.86	29.92	29.95	29.97	29.94	29.94	29.98	30.00	9.98
Cosenza	39 19 N.	16 17 E.	.07	.11	.98	.89	.96	.96	.95	.94	30.00	0.01	.03	0.04
Florence	43 46 N.	11 15 E.	.07	.09	.97	.84	.96	.96	.96	.93	9.98	9.99	.00	.00
Genoa	44 24 N.	8 55 E.	.05	.08	.97	.84	.96	.95	.97	.93	.97	.95	9.98	9.98
Lecca	40 22 N.	18 12 E.	.07	.08	.97	.87	.96	.94	.95	.91	.99	0.01	0.04	.99
Leghorn	43 33 N.	10 18 E.	.04	.06	.96	.83	.94	.95	.97	.93	.96	9.95	9.97	.97
Milan	45 28 N.	9 11 E.	.13	.16	.98	.85	.94	.94	.96	.93	.98	.95	0.04	0.03
Moncaliera	45 00 N.	7 41 E.	------	.16	.99	.85	.94	.93	.95	.92	.98	.98	9.99	.06
Padua	45 24 N.	11 53 E.	.10	.11	.98	.86	.94	.94	.95	.93	.98	.97	0.02	.01
Palermo	38 07 N.	13 21 E.	.03	.06	.98	.89	.99	.99	0.00	.98	0.01	0.01	.02	.01
Pesaro	43 55 N.	12 53 E.	.09	.09	.99	.86	.96	.96	9.97	.94	9.98	9.98	.01	.02
Rome	41 54 N.	12 29 E.	.03	.07	.96	.85	.93	.97	.97	.93	.98	.97	.00	9.98
Syracuse	37 03 N.	15 15 E.	.04	.08	.98	.89	.98	.98	.96	.94	.98	0.03	.05	0.01
Udine	46 04 N.	13 13 E.	.09	.10	.98	.86	.93	.94	.95	.92	.98	9.97	.01	.00
Naples	40 52 N.	14 15 E.	.07	.08	.97	.88	.94	.89	.97	.93	.98	0.01	.05	.02

Swiss:																
Geneva	46	12 N.	6	08 E.	.16	.14	0.04	.87	.97	.99	0.00	0.00	0.02	0.02	0.05	0.11
Swedish:																
Haparanda	65	47 N.	24	03 E.	29.88	29.88	29.75	29.92	29.88	29.83	29.79	29.80	29.88	29.80	29.74	29.68
Hernosand	62	32 N.	17	57 E.	.95	.89	.79	.92	.88	.85	.79	.80	.88	.82	.77	.70
Stockholm	59	20 N.	18	04 E.	.99	.95	.87	.93	.89	.84	.79	.80	.90	.83	.82	.73
Umea	63	50 N.	20	17 E.	.87	.87	.79	.93	.88	.84	.79	.80	.88	.82	.75	.69
Wisby	57	39 N.	18	19 E.	.97	.94	.87	.91	.89	.84	.81	.80	.90	.85	.82	.73
Upsala	59	51 N.	17	37 E.	.96	.94	.85	.94	.86	.81	.78	.79	.87	.83	.80	.67
Norwegian:																
Bergen	60	24 N.	5	20 E.	.90	.86	.86	.90	.88	.87	.80	.80	.82	.81	.74	.70
Brono	65	28 N.	12	14 E.	.81	.71	.75	.88	.82	.85	.82	.80	.75	.76	.65	.56
Christiania	59	55 N.	10	45 E.	.92	.94	.88	.92	.87	.82	.77	.78	.86	.84	.81	.74
Gjaesvaer	71	07 N.	25	22 E.	.61	.61	.56	.83	.86	.85	.80	.80	.79	.70	.57	.51
Portuguese:																
Angra	38	39 N.	27	14 W.	30.06	30.04	30.09	30.10	30.18	30.21	30.26	30.15	30.19	30.09	30.06	30.05
Campo Major	39	02 N.	6	59 W.	.21	.18	.05	29.97	29.98	.03	.00	29.97	.03	.04	.12	.16
Funchal	32	38 N.	16	55 W.	30.18	30.19	30.10	30.10	30.11	30.18	30.13	30.10	30.14	30.10	30.08	30.13
Lisbon	38	42 N.	9	08 W.	.18	.16	.04	9.98	.04	.09	.03	.04	.08	.07	.10	.17
Ponta Delgada	37	45 N.	25	41 W.	.14	.16	.14	0.13	.18	.24	.29	.21	.21	.14	.13	.17
Spanish:																
Barcelona	41	23 N.	2	15 E.	30.08	30.09	29.99	29.86	29.97	30.00	30.04	29.98	30.01	29.99	30.04	30.06
Bilboa	43	15 N.	2	59 W.	.14	.11	0.04	.91	0.04	.07	.08	0.03	.05	0.02	.05	.12
Burgos	42	20 N.	3	46 W.	.24	.22	.05	.93	.00	.03	.01	9.97	0.03	.09	.12	.19
Madrid	40	25 N.	3	42 W.	.19	.18	.02	.90	9.96	9.96	9.94	.91	9.97	.10	.11	.18
Murcia	37	59 N.	1	10 W.	.17	.12	.04	.89	.95	.99	0.00	.99	.03	.04	.10	.14
Santiago	42	53 N.	8	28 W.	.11	.06	9.99	.89	.99	0.04	.05	0.00	0.03	.01	.03	.12
Havana	23	08 N.	82	23 W.	.11	.08	0.08	0.03	0.08	.01	.04	.00	9.98	9.97	.06	.10
Manilla	14	35 N.	120	57 E.	9.99	9.99	9.96	9.91	9.88	9.87	9.83	9.85	.85	.91	9.86	9.98
San Fernando	36	28 N.	6	13 W.	0.19	.19	0.06	0.01	0.04	0.06	0.06	0.02	.08	0.10	0.10	0.18
San Juan, P. R	18	30 N.	66	10	.08	.08	.07	.04	.02	.05	.06	.02	9.99	9.95	9.99	.04
Turkish:																
Constantinople	41	02 N.	28	59 E.	30.12	30.14	30.01	29.93	29.83	29.89	29.89	29.91	29.99	30.05	30.07	30.08
Valona	40	27 N.	19	27 E.	.05	.09	.02	.93	.96	.97	.97	.88	30.11	.07	.09	.03
Beirut	33	54 N.	35	28 E.	.06	.02	9.97	.91	.94	.83	.76	.77	29.88	29.98	.02	.03
Netherlands:																
Flushing	51	24 N.	3	35 E.	30.10	30.06	30.03	9.88	30.00	9.99	9.99	9.96	9.98	9.93	9.92	9.95
Groningen	53	12 N.	6	34 E.	.09	.05	9.99	.89	9.97	.97	.95	.93	.93	.90	.90	.89
Helder	52	58 N.	4	45 E.	.07	.01	.99	.88	.97	.97	.94	.92	.93	.89	.85	.88

Stations.	Lat.	Long.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Netherlands—Continued.	° ′	° ′												
Hellevoetsluis	51 49 N.	4 08 E.	.08	.04	0.01	.88	.98	.97	.96	.94	.96	.91	.91	.92
Utrecht	52 05 N.	5 07 E.	.10	.04	.01	.89	.98	.97	.96	.95	.96	.93	.96	.93
Russian (European):														
Archangel	64 33 N.	40 32 E.	29.79	9.87	9.73	9.94	9.88	9.81	9.77	9.81	9.91	9.80	9.83	9.72
Astrakhan	46 21 N.	48 02 E.	0.21	0.24	0.06	.99	.93	.85	.80	.85	0.04	0.16	0.23	0.18
Dorpat	58 23 N.	26 43 E.	9.97	.03	9.90	.98	.92	.85	.81	.84	9.97	9.92	9.90	9.81
Kasan	55 47 N.	49 08 E.	0.09	.14	.96	0.01	.89	.82	.74	.78	.96	0.03	0.05	0.04
Kertch	45 21 N.	36 29 E.	.12	.14	.97	9.94	.93	.87	.84	.87	.99	.08	.11	.06
Kieff	50 27 N.	30 30 E.	.10	.13	.94	.92	.91	.84	.82	.85	0.00	.01	.04	9.99
Lugan	48 35 N.	39 20 E.	.13	.17	.96	.95	.89	.79	.76	.83	.00	.08	.12	0.06
Moscow	55 46 N.	37 40 E.	.04	.11	.92	0.00	.91	.81	.78	.81	.01	.01	.00	9.93
Nikolaiev	46 58 N.	31 58 E.	.14	.17	.98	9.95	.93	.88	.84	.89	.02	.06	.10	0.05
St. Petersburg	59 56 N.	30 16 E.	9.92	9.97	.86	.97	.90	.83	.78	.81	9.94	9.91	9.86	9.78
Tiflis	41 43 N.	44 47 E.	0.20	0.18	0.01	.95	.91	.82	.77	.79	.96	0.10	0.19	0.18
Warsaw	52 13 N.	21 02 E.	.09	.11	9.97	.91	.94	.89	.89	.89	.98	.00	9.98	9.94
Russian (Asia):														
Akmolinski	51 12 N.	71 23 E.	30.17	30.22	30.19	9.99	9.81	9.64	9.60	9.70	9.84	0.08	0.22	0.25
Barnaul	53 20 N.	83 47 E.	.39	.34	.25	0.10	.91	.72	.66	.75	.95	.17	.28	.38
Ekaterinburg	56 49 N.	60 38 E.	.10	.09	9.98	.00	.87	.76	.70	.74	.92	.03	.06	.08
Nertschinsk	51 19 N.	119 37 E.	.67	.50	0.30	.04	.87	.77	.77	.82	0.03	.26	.44	.51
Nikolaievsk	53 08 N.	140 45 E.	.00	.05	9.96	9.84	.80	.76	.72	.74	9.87	9.89	9.91	9.83
Pekin	39 57 N.	116 28 E.	.40	.37	0.20	.99	.78	.68	.66	.76	.98	0.14	0.90	0.40
Tashkend	41 20 N.	69 18 E.	.34	.32	.09	.95	.87	.74	.63	.66	.98	.16	.29	.30
Yeniseisk	58 27 N.	92 06 E.	.40	.35	.25	0.10	.96	.78	.76	.83	0.02	.14	0.35	.42
Japanese:														
Awomori	40 51 N.	140 45 E.	0.00	0.03	9.97	9.97	9.89	9.83	9.85	9.87	9.93	0.06	0.06	9.92
Hakodate	41 46 N.	140 44 E.	9.98	.91	.95	.97	.90	.84	.86	.87	.93	.06	.02	.91
Hiroshima	34 23 N.	132 27 E.	0.19	.18	0.12	0.05	.92	.81	.84	.83	.93	.10	.15	0.17
Kioto	35 01 N.	135 46 E.	.13	.16	.10	.01	.95	.84	.86	.88	.94	.08	.11	.14
Nagasaki	32 44 N.	129 52 E.	.23	.21	.14	.04	.94	.84	.85	.83	.91	.05	.18	.22
Niigata	37 55 N.	138 03 E.	.08	.10	.04	.02	.92	.83	.85	.88	.95	.07	.08	.02
Nobiru	38 23 N.	141 11 E.	.02	.04	.00	.01	.93	.85	-----	.90	.98	.07	.06	9.99
Tokio	35 41 N.	139 46 E.	.04	.08	.02	.03	.92	.86	.87	.89	.96	.08	.07	.99
Wakayama	34 14 N.	135 09 E.	.15	.15	.09	.02	.93	.84	.85	.86	.93	.10	.13	0.13

United States:																
Eastport, Me	44	54 N.	66	59 W.	30.01	0.05	9.90	9.91	9.97	9.95	9.93	9.99	0.05	30.04	9.98	9.99
Portland, Me	43	39 N.	70	15 W.	.04	.05	.94	.94	.98	.95	.93	.99	.06	.05	0.03	0.03
Boston, Mass	42	21 N.	71	04 W.	.08	.08	.97	.96	0.01	.99	.97	0.02	.10	.09	.06	.06
Block Island, R. I	41	10 N.	71	36 W.	.10	.12	.98	.97	.01	0.00	.99	.03	.10	.14	.08	.08
New Haven, Conn	41	18 N.	72	56 W.	.11	.11	0.01	.99	.02	.00	.98	.03	.10	.11	.09	.10
New London, Conn	41	21 N.	73	05 W.	.10	.11	.00	.98	.03	.01	.99	.03	.10	.10	.08	.09
Albany, N. Y	42	39 N.	73	45 W.	.12	.12	.02	0.00	.01	9.99	.97	.03	.10	.12	.11	.11
New York, N. Y	40	43 N.	74	0 W.	.11	.13	.03	.00	.03	0.01	0.00	.04	.11	.12	.10	.13
Philadelphia, Pa	39	57 N.	75	09 W.	.15	.14	.04	.01	.03	.02	.00	.04	.12	.13	.13	.14
Atlantic City, N. J	39	22 N.	74	25 W.	.12	.10	.03	.00	.03	.01	.00	.03	.11	.11	.11	.13
Baltimore, Md	39	18 N.	76	37 W.	.17	.15	.05	.02	.04	.01	.01	.04	.12	.13	.13	.15
Washington, D. C	38	54 N.	77	02 W.	.17	.10	.07	.04	.06	.04	.03	.06	.14	.15	.15	.17
Lynchburg, Va	37	25 N.	79	09 W.	.16	.15	.06	.04	.06	.05	.04	.06	.13	.15	.15	.16
Norfolk, Va	36	51 N.	76	17 W.	.16	.16	.07	.03	.05	.04	.03	.04	.11	.13	.15	.16
Hatteras, N. C	35	15 N.	75	40 W.	.15	.14	.06	.03	.04	.04	.04	.03	.08	.11	.13	.16
Wilmington, N. C	34	14 N.	77	57 W.	.18	.17	.09	.05	.06	.06	.06	.05	.10	.14	.17	.19
Charlotte, N. C.	35	13 N.	80	51 W.	.16	.17	.07	.04	.05	.06	.05	.05	.11	.14	.15	.17
Charleston, S. C	32	47 N.	79	58 W.	.18	.17	.10	.05	.05	.06	.06	.04	.08	.12	.15	.18
Augusta, Ga	33	28 N.	81	54 W.	.22	.21	.12	.07	.07	.07	.08	.06	.11	.15	.19	.21
Savannah, Ga	32	05 N.	81	05 W.	.19	.18	.11	.07	.06	.06	.07	.07	.08	.12	.16	.20
Jacksonville, Fla	30	20 N.	81	39 W.	.19	.18	.13	.07	.05	.07	.08	.05	.06	.09	.15	.19
Cedar Keys, Fla	29	08 N.	83	02 W.	.16	.18	.16	.06	.03	.06	.07	.02	.04	.06	.13	.17
Key West, Fla	24	34 N.	81	49 W.	.14	.13	.10	.05	.02	.05	.07	.02	9.99	.00	.07	.13
Atlanta, Ga	33	45 N.	84	23 W.	.19	.18	.11	.06	.08	.08	.08	.07	0.12	.16	.17	.20
Pensacola, Fla	30	25 N.	87	13 W.	.18	.17	.12	.06	.03	.04	.06	.02	.05	.10	.15	.18
Mobile, Ala	30	41 N.	88	02 W.	.19	.16	.12	.06	.04	.05	.07	.04	.06	.11	.17	.19
Montgomery, Ala	32	23 N.	86	18 W.	.20	.18	.11	.06	.05	.06	.07	.05	.08	.13	.18	.20
Vicksburg, Miss	32	22 N.	90	53 W.	.19	.16	.11	.04	.03	.04	.07	.04	.07	.13	.18	.20
New Orleans, La	29	58 N.	90	04 W.	.17	.13	.09	.03	.02	.03	.06	.02	.03	.09	.15	.17
Shreveport, La	32	30 N.	93	40 W.	.18	.12	.08	.00	.00	.01	.04	.02	.06	.10	.15	.17
Fort Smith, Ark	35	22 N.	94	24 W.	.18	.13	.06	9.98	9.97	9.98	.01	.01	.06	.11	.14	.17
Little Rock, Ark	34	45 N.	92	06 W.	.19	.14	.09	0.01	.99	0.00	.03	.02	.07	.12	.15	.19
Galveston, Tex	29	18 N.	94	47 W.	.15	.11	.06	.00	.98	.00	.04	.01	.01	.08	.13	.14
Brownsville, Tex	25	53 N.	97	26 W.	.14	.08	.03	9.95	.94	9.96	.00	9.97	9.98	.05	.10	.13
Rio Grande City, Tex	26	22 N.	98	45 W.	.20	.13	.08	0.00	.99	0.00	.03	0.01	0.04	.12	.18	.20
Palestine, Tex	31	45 N.	95	40 W.	.18	.13	.08	.01	0.00	.02	.06	.04	.06	.11	.16	.19
San Antonio, Tex	29	27 N.	98	28 W.	.16	.14	.05	9.97	9.95	9.96	.01	9.99	.02	.08	.13	.15
Chattanooga, Tenn	35	04 N.	85	15 W.	.20	.19	.14	0.06	0.07	0.07	.07	0.06	.13	.17	.19	.21

Stations.	Lat.		Long.		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
United States—Continued.	°	′	°	′												
Knoxville, Tenn	35	56 N.	83	58 W.	.21	.18	.11	.06	.08	.08	.09	.09	.15	.18	.19	.21
Memphis, Tenn	35	09 N.	90	03 W.	.18	.15	.09	.02	.02	.02	.05	.04	.09	.13	.17	.19
Nashville, Tenn	36	10 N.	86	47 W.	.17	.14	.09	.02	.03	.03	.04	.03	.10	.13	.15	.17
Louisville Ky	38	15 N.	85	45 W.	.17	.14	.08	.02	.02	.02	.04	.04	.10	.14	.15	.16
Indianapolis, Ind	39	46 N.	86	10 W.	.13	.11	.05	.00	.01	.00	.03	.04	.09	.11	.11	.14
Cincinnati, Ohio	39	06 N.	84	30 W.	0.17	.14	.07	.02	.03	.02	.03	.05	.11	.13	.14	.16
Columbus, Ohio	39	58 N.	83	00 W.	.15	.13	.06	.01	.02	.01	.03	.04	.10	.12	.12	.14
Pittsburg, Pa	40	32 N.	80	02 W.	.12	.11	.04	.00	.01	.00	.01	.03	.10	.10	.10	.12
Rochester, N. Y	43	08 N.	77	42 W.	.08	.09	.01	9.99	.00	9.98	9.97	.02	.08	.07	.05	.06
Buffalo, N. Y	42	53 N.	78	53 W.	.07	.08	.00	.99	.00	.99	.98	.02	.08	.07	.04	.06
Oswego, N. Y	43	29 N.	76	35 W.	.08	.09	.02	0.00	.01	.98	.97	.02	.08	.08	.05	.07
Erie, Pa	42	07 N.	80	05 W.	.10	.10	.03	.00	.01	.99	.99	.02	.09	.08	.07	.08
Cleveland, Ohio	41	30 N.	81	42 W.	.12	.10	.04	.01	.02	0.00	0.01	.03	.09	.09	.09	.11
Sandusky, Ohio	41	25 N.	82	40 W.	.12	.11	.04	.01	.02	.00	.02	.04	.09	.09	.09	.11
Toledo, Ohio	41	40 N.	83	34 W.	.10	.09	.04	.01	.01	.00	.02	.04	.09	.09	.07	.10
Detroit, Mich	42	20 N.	83	03 W.	.10	.09	.04	.01	.01	9.99	.00	.03	.08	.08	.07	.09
Alpena, Mich	45	05 N.	83	30 W.	.04	.06	.02	.00	9.99	.95	9.96	.00	.03	.03	.01	.03
Escanaba, Mich	44	48 N.	87	05 W.	.06	.07	.04	.00	.99	.95	.96	.00	.02	.02	.02	.03
Grand Haven, Mich	43	05 N.	86	18 W.	.06	.05	.02	9.99	.99	.97	.98	.01	.05	.05	.04	.05
Mackinac City, Mich	45	47 N.	84	39 W.	.05	.07	.03	0.01	.99	.96	.97	.02	.04	.02	.01	.01
Marquette, Mich	46	34 N.	87	24 W.	.06	.08	.05	.02	0.00	.96	.97	.01	.01	.02	.02	.04
Port Huron, Mich	43	0 N.	82	26 W.	.07	.08	.02	9.99	.00	.99	.99	.02	.07	.07	.05	.06
Chicago, Ill	41	52 N.	87	38 W.	.09	.07	.04	.99	9.99	.97	.99	.01	.06	.07	.07	.08
Milwaukee, Wis	43	02 N.	87	54 W.	.08	.07	.03	.99	.99	.97	0.00	.02	.05	.05	.05	.07
Duluth, Minn	46	48 N.	92	06 W.	.10	.11	.08	0.03	0.00	.95	9.94	9.99	.01	.02	.04	.08
St. Paul, Minn	44	58 N.	93	03 W.	.10	.08	.04	9.97	9.95	.91	.96	.98	.00	.01	.04	.08
La Crosse, Wis	43	49 N.	91	15 W.	.11	.09	.05	.98	.97	.94	.97	0.00	.03	.04	.07	.10
Davenport, Iowa	41	30 N.	90	38 W.	.13	.10	.06	.99	.99	.97	0.01	.02	.07	.09	.10	.13
Des Moines, Iowa	41	35 N.	93	37 W.	.15	.14	.07	.99	.98	.96	.01	.02	.05	.09	.10	.15
Dubuque, Iowa	42	30 N.	90	44 W.	.13	.11	.06	.98	0.00	.96	.01	.03	.06	.07	.09	.13
Keokuk, Iowa	40	22 N.	91	20 W.	.14	.10	.05	.98	9.97	.96	.00	.01	.05	.09	.10	.13
Cairo, Ill	37	0 N.	89	10 W.	.19	.15	.08	0.01	0.01	0.01	.04	.04	.09	.13	.15	.18
Springfield, Ill	39	48 N.	89	39 W.	.16	.13	.07	.01	.01	.00	.03	.05	.09	.12	.13	.17
St. Louis, Mo	38	38 N.	90	12 W.	.17	.13	.08	.00	.00	.00	.03	.04	.09	.12	.15	.17

Leavenworth, Kans	39	19 N.	94	57 W.	.19	.14	.08	9.99	9.98	9.97	.01	.03	.07	.10	.14	.18
Omaha, Nebr	41	16 N.	95	56 W.	.19	.16	.09	0.00	.97	.96	.01	.03	.06	.10	.14	.17
Fort Sully, S. Dak	44	39 N.	100	39 W.	.09	.07	.08	.01	.94	.92	9.96	9.99	.03	.05	.10	.15
Huron, Dak	44	21 N.	98	09 W.	.17	.14	.10	9.98	.95	.93	.96	.97	.01	.04	.10	.15
Yankton, S. Dak	42	54 N.	97	23 W.	.16	.14	.08	.98	.95	.54	.97	.99	.02	.05	.10	.15
Moorhead, Minn	46	52 N.	99	44 W.	.15	.14	.09	0.01	.96	.91	.95	.98	.(0	.03	.08	.13
St. Vincent, Minn	48	56 N.	97	14 W.	.16	.15	.12	.04	.98	.93	.95	.97	9.99	.03	.09	.14
Bismarck, N. Dak	46	47 N.	100	38 W.	.11	.09	.08	.00	.94	.91	.95	.98	0.00	.02	.07	.11
Fort Buford, N. Dak	48	00 N.	103	56 W.	.07	.07	.01	9.94	.87	.83	.87	.89	9.94	9.97	.01	.08
Fort Assinniboine, Mont	48	32 N.	109	42 W.	.13	.10	.04	.99	.96	.91	.93	.96	.99	0.04	.08	.11
Fort Custer, Mont	45	42 N.	107	34 W.	.11	.07	.05	0.00	.96	.91	.94	.93	0.01	.05	.11	.13
Fort Maginnis, Mont	47	12 N.	109	10 W.	.05	.06	.01	9.98	.96	.92	.95	.96	9.99	.02	.03	.05
Helena, Mont	46	34 N.	112	04 W.	.12	.08	.03	0.00	.96	.93	.96	.95	.99	.04	.10	.13
Deadwood, S. Dak	44	23 N.	103	43 W.	.09	.09	.06	.01	.96	.94	.97	.96	0.04	.05	.11	.11
Cheyenne, Wyo	41	08 N.	104	48 W.	.09	.08	.05	9.99	.94	.92	.93	.95	9.99	.05	.09	.08
North Platte, Nebr	41	08 N.	100	45 W.	.17	.14	.08	.99	.94	.94	.98	.99	0.03	.07	.13	.16
Denver, Colo	39	45 N.	105	0 W.	10	.06	.01	.94	.91	.89	.90	.91	9.94	.02	.09	.07
Las Animas, Colo	38	04 N.	103	07 W.	.15	.09	.02	.93	.92	.88	.90	.94	.97	.03	.11	.11
Dodge City, Kans	37	45 N.	100	0 W.	.16	.13	.06	.96	.95	.93	.99	0.01	0.06	.08	.13	.10
Fort Elliott, Tex	35	30 N.	100	21 W.	.08	.05	9.99	.91	.89	.88	.93	9.95	9.99	.03	.06	.07
Fort Sill, Okla	34	40 N.	98	23 W.	.16	.15	0.07	.97	.96	.96	0.01	0.01	0.05	.10	.15	.17
Fort Davis, Tex	30	38 N.	103	56 W.	.13	.09	.04	.98	.96	.96	9.99	.00	.02	.08	.12	.13
Santa Fé, N. Mex	35	41 N.	105	57 W.	.14	.10	.03	.97	.93	.91	.95	9.98	.00	.03	.10	.11
Fort Apache, Ariz	33	48 N.	109	57 W.	.17	.12	.09	0.00	.97	.95	.96	.97	.00	.03	.13	.15
Fort Grant, Ariz	32	39 N.	109	57 W.	.14	.12	.06	-.00	.96	.93	.97	.96	9.98	.02	.11	.14
Prescott, Ariz	34	33 N.	112	28 W.	.14	.10	.06	9.96	.94	.92	.94	.95	.98	.04	.09	.11
Yuma, Ariz	32	45 N.	114	36 W.	.08	.05	9.99	.91	.84	.79	.81	.79	.81	9.92	.03	.07
El Paso, Tex	31	47 N.	106	30 W.	.14	.09	0.03	.96	.92	.90	.94	.95	.97	0.04	.12	.15
Salt Lake City, Utah	40	46 N.	111	54 W.	.14	.08	.06	.96	.93	.89	.89	.90	.96	.07	.19	.18
Winnemucca, Nev	40	58 N.	117	43 W.	.15	.09	.06	.93	.95	.92	.90	.89	.97	.07	.16	.16
Boisé City, Idaho	43	37 N.	116	08 W.	.22	.13	.08	0.02	.98	.95	.94	.94	0.02	.11	.20	.20
Spokane Falls, Wash	47	40 N.	117	25 W.	.11	.08	.03	.00	0.00	.96	.96	.96	.00	.06	.13	.11
Olympia, Wash	47	03 N.	122	53 W.	.04	.02	.01	.03	.06	0.06	0.06	0.03	.04	.06	.07	.04
Portland, Oreg	45	32 N.	122	43 W.	.10	.07	.04	.06	.07	.07	.07	.03	.04	.08	.11	.08
Roseburg, Oreg	43	13 N.	123	20 W.	.13	.10	.07	.09	.08	.09	.07	.05	.06	.11	.15	.12
Red Bluff, Cal	40	10 N.	122	15 W.	.14	.09	.04	.01	9.96	9.91	9.89	9.87	9.93	.02	.11	.12
Sacramento, Cal	38	35 N.	121	30 W.	.15	.10	.06	.02	.97	.91	.89	.87	0.01	.01	.10	.13
San Francisco, Cal	37	48 N.	122	26 W.	.15	.11	.08	.04	0.00	.96	.95	.93	9.94	.02	.11	.12

Stations.	Lat.	Long.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
United States—Continued.	° ′	° ′												
Los Angeles, Cal	34 03 N.	118 15 W.	.08	.06	.05	.01	9.96	.93	.94	.91	.91	9.98	.04	.07
San Diego, Cal	32 43 N.	117 10 W.	.10	.08	.06	.02	.96	.94	.95	.92	.92	.99	.05	.08
United States, substations:														
Kingston, Jamaica	18 01 N.	76 48 W.	0.10	0.07	0.10	0.05	0.02	0.05	0.06	0.03	0.01	0.00	0.03	0.06
Paramaribo, S. A	5 50 N.	55 13 W.	.06	.03	.03	.02	.04	.05	.04	.03	0.2	.01	.00	.03
Puerto Berrio	6 22 N.	74 28 W.	9.95	.97	9.98	.00	.01	9.93	9.92	.01	9.99	9.98	.02	9.95
Rivas, Nicaragua	11 26 N.	85 47 W.		0.08	0.15	.06	.08	0.05	0.06		0.01	.98	.15	0.02
Leon, Mexico	21 07 N.	101 36 W.	0.23	.18	.08	.02	9.98	9.98	.03	9.94	9.97	.96	.18	.21
Mazatlan, Mexico	23 12 N.	106 17 W.	.03	.02	9.99	9.97	.94	.87	9.95	.91	.85	.83	9.94	.02
Mexico, Mexico	19 26 N.	99 00 W.	.27	.24	0.19	0.10	0.07	0.05	0.13	0.05	0.06	0.18	0.28	.29
Puebla, Mexico	19 03 N.	98 03 W.	.27	.28	.18	.15	.11	.07	.16	.08	.07	.15	.26	.28
Arctic:														
North Sea Bay	76 34 N.	68 45 W.	29.84	29.37	30.00	9.72	29.83	29.63	29.60	29.78	29.77	29.60	29.83	9.67
Rensselaer Harbor	78 37 N.	70 40 W.	.77	.84	9.74	.90	.94	.71	.74	.71	.65	.75	.75	.75
Foulke Fiord	70 19 N.	66 00 W.	.83	.75	.82	0.06	.98	.68	.69			.62	30.09	0.03
Polaris House	78 18 N.	70 21 W.	.68	.90	.80	.22	0.05	.71					9.93	9.86
Camp Clay	75 54 N.	74 30 W.	.83	.71	.82	.14?	.12?						.80	.90
Polaris Bay	81 38 N.	61 44 W.	.79	.89	0.19	.20	.03	9.86	.79	.79	.98	.97	0.23	.75
Discovery Harbor	81 44 N.	64 45 W.	.68	.99	.10	.33	9.93	.80	.60	.75	.70	.98	.19	.65
Fort Conger	81 44 N.	64 45 W.	.80	.67	9.89	.10	0.07	.88	.79	.83	.77	.90	9.86	.92
Floeberg Beach	82 27 N.	61 18 W.	.61	.98	0.10	.30	9.92	.80	.60	.72	.68	.95	0.15	.61
Winter Harbor	74 47 N.	110 48 W.	0.08	.77	9.80	9.98	0.11	.82	.67	.73	.90	.81	9.94	.86
Princess Royal Island	72 47 N.	117 35 W.	9.94	0.01	0.04	0.10	.08	.88	.80	.91	.94	.92	.81	.04
Walker Bay	71 35 N.	117 39 W.	.90	9.85	.16	.03	.00	.82	.76	.85	.93	.86	0.09	.11
Mercy Bay	74 06 N.	117 55 W.	.85	0.00	.14	.12	.08	.82	.77	.88	.86	.99	.10	0.04
Dealy Island	74 56 N.	108 49 W.	.75	.12	.10	.11	.06	.82	.63	.70	.84	.97	.08	9.94
Melville Sound	74 42 N.	101 22 W.	.68	9.76	9.88	.10					.82	.81	9.82	.84
Igloolik	69 21 N.	81 53 W.	.75	.84	0.03	9.97	9.91	.93	.53	.50	.73	.83	.71	.59
Boothia	70 00 N.	92 00 W.	.82	.98	9.97	.99	0.14	0.02	.89	.86	.82	.96	.94	.92
Cambridge Bay	69 03 N.	105 12 W.	.80	.95	0.06	0.02	.03	9.81	.68			.95	0.01	.93
Port Kennedy	72 01 N.	94 14 W.	.97	.92	.16	.17	.00	.90	.70		0.00	.79	.04	.86
Ivigtut	62 12 N.	48 10 W.	.40	.48	9.68	9.76	9.83	.77	.77	.78	9.73	.65	9.67	.48
Godthaab	64 11 N.	51 44 W.	.45	.52	.71	.79	.85	.78	.77	.78	.72	.65	.67	.51
Jacobshavn	69 13 N.	51 02 W.	.57	.66	.82	.89	.90	.79	.76	.79	.74	.72	.75	.60

Upernivik	72	47 N.	55	53 W.	.60	.69	.87	.98	.92	.84	.78	.81	.74	.75	.75	.69
Port Bowen	73	13 N.	88	55 W.	.76	.89	0.11	0.07	0.05	.89	.82	.68	.69	.96	.90	.87
Port Lepold	73	50 N.	90	12 W.	.82	.82	9.91	9.96	9.99	.84	.67	.68	.74	.84	.84	.69
Griffith Island	74	34 N.	95	20 W.	.73	.83	.85	0.08	.99	.98	.80	------	.68	.95	.91	.84
Northumberland Sound	76	52 N.	97	00 W.	.70	0.05	.08	.02	.91	.72	.61	.66	.78	.94	0.05	.89
Wellington Channel	75	31 N.	92	22 W.	.61	9.72	.84	.00	.98	.76	.64	.73	.74	.79	9.72	.81
Beechy Island	74	43 N.	91	54 W.	.83	0.02	0.18	.21	0.20	0.01	.87	.81	.86	.94	.96	.91
Winter Island	66	11 N.	83	10 W.	.79	9.59	9.69	9.74	9.83	9.72	.53	.70	.88	.72	.98	.76
Repulse Bay	66	32 N.	86	56 W.	.79	0.15	0.17	------	------	------	.92	------	------	.86	.93	0.06
Marble Island	62	33 N.	91	06 W.	.76	.12	.07	0.13	0.09	.92	.69	------	.90	.86	.85	9.89
Sabine Island	74	32 N.	18	49 W.	.78	9.98	.17	9.86	9.87	.92	.71	.95	.86	.87	.76	.80
Jan Mayen	70	58 N.	8	35 W.	.41	.29	9.98	.76	.78	.94	.82	.69	.64	.78	.61	.89
Camden Bay	70	08 N.	145	29 W.	.12	.99	.98	.87	.83	.85	.84	------	.89	.88	0.30	.80
Point Barrow	71	16 N.	156	40 W.	9.90	.97	0.05	0.00	.98	.91	.84	.79	.81	.90	9.86	.99
St. Michaels	63	28 N.	161	48 W.	.78	0.00	9.89	9.86	.81	.84	.86	.80	.70	.72	.75	.81
Fort Alexander	58	57 N.	158	18 W.	.62	9.92	.86	.80	.78	.88	.59	.87	.76	.69	.57	.68
St. Paul Island	57	09 N.	170	18 W.	.61	.76	.88	.85	.78	.78	.86	.88	.69	.57	.57	.57
Sitka	57	03 N.	135	19 W.	.55	.64	.65	.71	.84	.89	.88	.85	.76	.62	.61	.63
Unalaska	53	52 N.	166	31 W.	.56	.65	.66	.70	.70	.76	.83	.84	.66	.58	.57	.64
Nova Zembla	76	?	59	? E.	.58	.72	.69	0.04	0.01	.80	.82	.81	.76	.86	.97	.83
Vardo	70	22 N.	31	07 E.	.48	.60	.53	9.76	9.83	.77	.76	.72	.72	.65	.61	.59
Spitzbergen	79	53 N.	16	04 E.	.44	.45	.70	.85	.93	.72	.64	.78	.67	.71	.69	.78
Petro-pawlowsk	53	00 N.	158	39 E.	.52	.63	.77	.77	.70	.65	.69	.81	.80	.72	.62	.54
Okhotsk	59	20 N.	142	40 E.	.63	.92	.90	.85	.80	.77	.72	.80	.85	.82	.76	.71
Bering Island	55	12 N.	165	55 E.	.47	.83	.78	.79	.79	.80	.80	.82	.88	.69	.55	.55
Gydaviken	72	20 N.	77	00 E.	.91	0.10	.69	.84	.74	.89	.89	------	------	.84	.39	.92
Anadyr	64	55 N.	177	19 E.	0.12	.07	.86	.95	.90	.91	------	------	------	.79	.86	.91
Pitlekaie	67	05 N.	173	23 W.	9.64	.24	.89	.79	.91	.78	.73	------	------	.84	.68	.96
Lena Delta	73	23 N.	124	01 E.	.95	.10	0.12	0.05	.79	.67	.84	.78	.69	.76	.87	.94
Neweja Semlja	72	23 N.	52	01 E.	.64	9.71	9.58	.15	.96	88	.72	.87	.88	0.02	.91	.97
Jeannette	73	28 N.	179	47 E.	0.20	0.12	0.07	.00	.94	.68	.60	.83	.85	9.99	.86	.98
Miscellaneous:																
Bangkok	13	38 N.	100	27 E.	29.98	9.94	9.91	79.85	9.81	9.79	9.80	9.80	9.81	9.88	9.98	0.00
Prai-a-Santiago	14	54 N.	23	31 W.	.88	.88	.87	.87	.88	.91	.87	.85	.84	9.85	.85	9.87
Krasnoyarsk	56	01 N.	92	53 E.	0.08	0.04	.95	.82	.66	.55	.53	.67	.82	.91	0.04	20.11
Irkutsk	52	16 N.	104	05 E.	9.78	8.72	8.62	8.59	8.35	8.26	8.19	8.26	8.45	8.59	8.66	38.68
Port Said	29	58 N.	32	34 E.	0.08	0.10	9.93	9.94	9.90	9.85	9.76	9.79	9.88	9.98	0.06	20.05
Cairo	29	59 N.	31	18 E.	9.85	9.85	.96	.99	0.02	0.06	0.13	0.12	0.01	.93	9.88	29.84

Stations.	Lat.	Long.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Miscellaneous—Cont'd.	° ′	° ′												
Red Sea, coast of	26 05 N.	34 16 E.	0.21	0.18	0.06	30.03	.01	9.90	9.86	9.84	9.89	0.04	0.09	30.15
Yarkand	38 25 N.	77 16 E.	26.20	25.97	25.87	25.89	25.84	25.74	25.65	25.76	25.97	26.14	26.18	16.09
Leh	34 10 N.	77 36 E.	19.53	19.48	19.42	19.63	19.61	19.56	19.56	19.57	19.61	19.66	19.70	39.67
Smyrna	38 26 N.	27 10 E.	30.03	29.97	29.85	29.92	29.89	29.84	29.77	29.77	29.91	29.98	29.99	30.00
New Chwano	40 57 N.	121 27 E.	:46	0.35	0.27	30.01	30.00	.83	.83	.93	0.13	0.27	30.25	0.35
Beresow	63 56 N.	65 04 E.	9.89	9.95	9.68	9.95	9.87	.80	.66	.70	9.84	9.76	9.78	9.94
Duë	50 50 N.	142 26 E.	.53	48	.44	.36	.37	.38	.37	.38	.46	.50	.41	.48
Bermuda	32 23 N.	64 40 W.	0.11	0.12	0.04	0.02	0.03	0.13	0.14	.10	0.07	0.02	0.03	0.10
Vera Cruz, Mex	19 12 N.	96 09 W.	.10	.04	9.97	9.96	9.89	9.89	9.97	9.99	9.97	9.98	.07	2 .08
Cordoba	18 51 N.	96 54 W.	27.18	27.13	27.10	27.08	27.06	27.09	27.13	27.13	27.12	27.13	27.18	37.20
Belize	17 30 N.	88 18 W.	30.05	30.05	30.00	9.99	9.92	9.95	9.99	9.98	9.94	29.93	30.03	20.05
Guatemala	14 38 N.	90 31 W.	25.27	25.26	25.25	25.23	25.22	25.22	25.25	25.24	25.21	25.21	25.26	25.28
San José	9 56 N.	84 00 W.	26.31	26.32	26.32	26.32	26.31	26.31	26.31	26.31	26.30	26.29	26.29	26.30
Medellin, New Granada	6 02 N.	75 49 W.	25.20	25.20	25.20	25.20	25.20	25.20	25.21	25.21	25.22	25.22	25.18	5.20
Harbor Grace	47 22 N.	55 25 W.	29.88	9.80	29.84	29.82	9.94	30.01	0.02	0.07	30.01	29.90	29.83	29.76
Verone	43 06 N.	77 47 E.	30.23	30.28	30.07	29.88	.76	9.64	9.53	9.60	9.84	30.12	30.32	30.28
Nikolsk	59 17 N.	45 33 E.	.11	.33	.00	30.07?	0.07?	.93	.96	.91	.96	29.99	30.06	29.87
Semipalatinsk	50 33 N.	80 06 E.	.41	.43	.32	.13	9.95	.72	.70	.78	.94	30.21	30.48	30.50
Tomsk	55 00 N.	85 00 E.												0.58
Bielosersk	60 00 N.	26 59 E.	9.85	0.12	.03	.17	.83	.90	.82	.86	0.01	9.87	0.16	9.77
Sung-chu-Chwang	37 59 N.	102 48 E.	24.65	24.58	24.54	25.10	25.17	25.04				25.36		25.06
Nemuro	43 20 N.	145 35 E.	29.89	29.86	29.87	29.96	29.91	29.87	29.88	29.91	29.96	30.04	29.94	29.81
Swift Current	50 21 N.	107 33 W.	0.15	0.22	0.02	.93	.90	.87		.90	.93	.03	0.07	0.11
Province Wellesley	5 22 N.	100 30 E.	9.90	9.88	9.86	.84	.85	.85	.83	.86	.88	9.87	9.86	9.88
Honolulu	21 18 N.	157 55 E.	0.92	0.04	0.08	0.08	0.12	0.14	0.12	0.07	0.06	0.05	0.05	0.05
St. Thomas	0 20 N.	6 43 E.	9.88	9.85	9.86	9.89	9.89	9.96	9.98	9.98	9.95	9.92	9.90	9.90
Fort Chimo	58 00 N.	68 00 W.	.86	.93	.88	0.06	0.00	.88	.96	.93	.77	.93	.96	.97
Tatoosh			.94	.96	.96	.00	.02	0.03	0.05	0.02	.99	0.03	0.00	.95
Chabarowka	48 28 N.	135 07 E.	0.10	0.13	0.02	9.91	9.74	9.78	9.73	9.78	.81	.00	.12	0.13
Waldiwostock	43 09 N.	132 00 E.	.17	.19	9.97	.94	.80	.86	.75	.83	.98	.08	.14	.17
Olekminsk	60 22 N.	120 26 E.	.77	0.73	0.49	0.25	0.13	0.00	0.02	0.08	0.26	.38	.56	.64
Mesen	65 50 N.	14 16 E.	9.62	0.02	9.88	9.91	9.83	9.84	9.77	9.81	9.70	9.74	9.80	9.65
Turnkhansk	65 55 N.	87 38 E.	0.30	.18	0.14	0.05	0.05	94	.92	.97	0.02	0.07	0.22	0.44

Sinjaja	65	41 N.	40	14 E.	9.61	9.85	9.70	9.89	9.90	9.86	.80	.83	9.91	9.87	9.70	9.80
Powenz	62	51 N.	34	49 E.	0.08	0.00	.86	.99	.96	.87	.84	.86	0.00	.97	.83	.88
Boosslowsk	59	45 N.	60	01 E.	9.94	9.95	.90	.93	0.01	.88	.78	.85	9.95	0.04	0.07	0.06
Obdsrsk	66	31 N.	66	35 E.	0.32	0.27	0.15	0.16	0.09	0.17	0.09	0.04	9.97	0.05	0.20	0.07
Schenkursk	62	06 N.	42	54 E.	.03	.67?	.10	.13	.00	9.92	9.81	9.78	.78	.19	.07	9.86
Werchojansk	67	34 N.	133	51 E.	9.93	9.85	9.79	9.62	9.47	9.31				9.59	9.79	.77
Krassnowidsk	56	01 N.	92	49 E.	0.34	0.37	0.24	0.15	0.11	.95	0.01	0.07	0.26	0.42	0.48	0.46
Kasalinsk	45	46 N.	62	07 E.	.12	.40	9.99	9.88	9.83	.68	9.59	9.65	9.85	.10	.18	.22
Samarkand	39	49 N.	67	18 E.	.28	.29	0.11	.96	.90	.71	.64	.67	.93	.15	.24	.28
Petro-Alexandaswsk	41	30 N.	61	00 E.	.28	.36	.08	.94	.90	.75	.71	.74	.96	.19	.26	.26
Bakau	40	21 N.	49	51 E.	.20	.29	9.99	.98	.95	.83	.83	.84	.98	.13	.18	.13
Ashurada	36	54 N.	53	55 E.	.15	.20	0.03	0.00	.94	.80	.80	.82	.00	.16	22	.11

Ocean squares.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
12.5—22.5	30.00	29.97	30.01	30.01	30.00	30.03	30.01	29.98	29.98	29.98	29.99	29.99
12.5—27.5	.03	30.00	.03	.03	.01	.05	.01	30.00	30.00	30.00	30.00	30.00
12.5—32.5	.04	.02	.04	.04	.06	.06	.06	.01	.00	.01	29.99	.01
12.5—37.5	.05	.93	.06	.07	.07	.07	.08	.03	.01	.02	30.00	.03
12.5—42.5	.06	.03	.05	.07	.08	.08	.09	.03	.02	.02	.00	.03
12.5—47.5	.05	.04	.06	.06	.07	.08	.10	.03	.01	.02	.00	.03
12.5—52.5	.03	.04	.04	.04	.06	.06	.08	.03	.00	.00	.01	.02
12.5—57.5	--------	9.99	9.98	.00	.02	.07	.05	.01	9.98	9.99	.00	.01
17.5—22.5	30.07	30.03	30.06	30.06	30.04	30.06	30.04	30.01	30.01	30.02	30.02	30.04
17.5—27.5	.08	.06	.08	.07	.07	.09	.06	.02	.03	.03	.04	.04
17.5—32.5	.10	.07	.08	.10	.10	.12	.11	.06	.04	.04	.04	.05
17.5—37.5	.12	.10	.10	.10	.12	.13	.13	.08	.06	.06	.06	.07
17.5—42.5	.12	.11	.10	.11	.12	.13	.13	.08	.06	.05	.05	.07
17.5—47.5	.11	.11	.10	.10	.11	.13	.14	.08	.05	.03	.05	.07
17.5—52.5	.10	.08	.08	.08	.09	.11	.11	.06	.03	.01	.03	.06
17.5—57.5	.08	.08	.07	.05	.06	.08	.08	.03	.01	.00	.00	.06
22.5—22.5	30.11	30.10	30.10	30.11	30.10	30.13	30.10	30.06	30.07	30.06	30.06	30.08
22.5—27.5	.11	.13	.13	.11	.13	.15	.13	.09	.09	.09	.09	.10
22.5—32.5	.14	.15	.12	.12	.16	.17	.16	.10	.09	.10	.09	.10
22.5—37.5	.15	.17	.15	.11	.17	.19	.18	.13	.10	.09	.09	.11
22.5—42.5	.18	.16	.14	.10	.17	.19	.19	.14	.14	.07	.10	.12
22.5—47.5	.18	.15	.12	.11	.16	.19	.20	.13	.09	.07	.10	.12
22.5—52.5	.16	.14	.12	.08	.13	.17	.16	.12	.08	.04	.07	.12
22.5—57.5	.15	.13	.11	.08	.11	.14	.14	.10	.05	.04	.06	.11
22.5—61.5	.14	.13	.12	.07	.09	.12	.12	.08	.03	.00	.04	.10
22.5—67.5	.15	.12	.11	.07	.07	.10	.11	.07	.02	9.99	.04	.10
22.5—72.5	.13	.11	.11	.05	.05	.08	.08	.04	.02	.99	.03	.10
27.5—22.5	30.15	0.16	0.14	0.12	0.14	0.18	0.17	0.12	0.13	0.11	0.10	0.13
27.5—27.5	.15	.18	.16	.12	.18	.20	.20	.15	.14	.11	.11	.12
27.5—32.5	.15	.16	.16	.13	.20	.21	.24	.17	.16	.12	.13	.12
27.5—37.5	.17	.21	.16	.12	.21	.21	.25	.19	.18	.12	.11	.12

27.5—42.5	.22	.19	.16	.11	.21	.23	.25	.18	.15	.10	.12	.12
27.5—47.5	.21	.18	.13	.08	.19	.20	.23	.18	.14	.10	.11	.13
27.5—52.5	.19	.19	.11	.07	.16	.20	.20	.16	.12	.09	.11	.14
27.5—57.5	.20	.16	.09	.06	.13	.18	.18	.14	.09	.05	.11	.14
27.5—62.5	.18	.16	.10	.07	.10	.14	.16	.11	.07	.03	.09	.14
27.5—67.5	.18	.14	.11	.08	.09	.12	.12	.09	.05	.02	.08	.14
27.5—72.5	.17	.14	.11	.07	.07	.10	.11	.08	.04	.03	.09	.14
27.5—77.5	.16	.15	.11	.07	.05	.08	.08	.03	.03	.04	.09	.15
32.5—12.5	30.18	30.17	30.10	30.08	30.09	30.14	30.11	30.05	30.11	30.12	30.11	30.16
32.5—17.5	.17	.19	.13	.11	.13	.19	.17	.12	.15	.14	.10	.15
32.5—22.5	.14	.17	.16	.13	.16	.23	.22	.17	.17	.16	.09	.15
32.5—27.5	.14	.18	.15	.14	.20	.24	.27	.20	.18	.16	.13	.13
32.5—32.5	.15	.19	.15	.12	.21	.24	.28	.22	.20	.16	.12	.14
32.5—37.5	.14	.19	.12	.08	.22	.23	.28	.22	.19	.15	.12	.12
32.5—42.5	.14	.17	.10	.08	.20	.23	.26	.22	.18	.13	.14	.12
22.5—47.5	.15	.15	.06	.05	.18	.19	.23	.20	.14	.11	.13	.11
32.5—52.5	.16	.14	.04	.03	.14	.17	.20	.18	.12	.08	.13	.11
32.5—57.5	.16	.14	.03	.02	.10	.15	.17	.14	.10	.07	.11	.11
32.5—62.5	.15	.10	.03	.03	.07	.12	.13	.10	.09	.06	.11	.11
32.5—67.5	.16	.14	.04	.03	.06	.10	.09	.07	.08	.07	.10	.13
32.5—72.5	.16	.14	.06	.05	.06	.06	.07	.06	.08	.09	.13	.15
32.5—77.5	.17	.16	.08	.05	.05	.05	.04	.04	.08	.10	.17	.18
37.5—12.5	30.17	30.15	30.06	30.01	30.07	30.13	30.11	30.07	30.11	30.08	30.10	30.17
37.5—17.5	.15	.14	.10	.06	.11	.20	.18	.13	.15	.11	.11	.16
37.5—22.5	.13	.14	.14	.10	.16	.24	.26	.19	.19	.18	.11	.16
37.5—27.5	.12	.13	.15	.12	.18	.24	.29	.23	.18	.19	.13	.14
37.5—32.5	.10	.10	.11	.06	.18	.22	.27	.22	.19	.14	.12	.09
37.5—37.5	.08	.07	.06	.04	.18	.19	.24	.21	.17	.11	.11	.08
37.5—42.5	.06	.04	.01	.00	.16	.16	.21	.18	.16	.09	.10	.06
37.5—47.5	.06	.02	9.98	9.99	.14	.13	.17	.16	.13	.08	.10	.07
37.5—52.5	.06	.01	.96	.95	.11	.10	.14	.13	.13	.06	.08	.06
37.5—57.5	.07	.01	.93	.95	.07	.08	.10	.09	.12	.06	.06	.05
37.5—62.5	.07	.02	.94	.95	.05	.04	.04	.06	.10	.06	.07	.05
37.5—67.5	.10	.07	.98	.96	.04	.03	.03	.05	.10	.08	.08	.07
37.5—72.5	.12	.10	0.01	0.00	.03	.01	.01	.03	.09	.11	.12	.11

Ocean squares.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
42.5—12.5	30.09	30.04	30.01	9.91	30.02	80.10	30.10	30.05	30.08	30.05	30.06	30.12
42.5—17.5	.05	.02	.02	.95	.07	.15	.16	.10	.10	.08	.05	.12
42.5—22.5	.04	.00	.04	.99	.10	.18	.24	.12	.13	.10	.06	.09
42.5—27.5	9.99	9.98	.02	.99	.12	.16	.22	.14	.13	.10	.07	.06
42.5—32.5	.99	.92	.00	.99	.13	.15	.24	.12	.14	.04	.06	.02
42.5—37.5	.95	.89	9.96	.94	.12	.11	.14	.11	.11	.02	.04	.00
42.5—42.5	.94	.90	.92	.90	.10	.09	.12	.09	.10	.02	.03	9.99
42.5—47.5	.95	.90	.89	.89	.09	.05	.08	.07	.10	.02	.02	.97
42.5—52.5	.97	.90	.86	.86	.06	.03	.04	.05	.10	.02	.02	.97
42.5—52.5	.96	.92	.86	.87	.04	.00	.01	.02	.10	.03	.01	.97
42.5—57.5	0.00	.99	.89	.89	.01	9.98	9.98	.01	.10	.05	.03	.99
42.5—62.5	.03	.00	.94	.92	.00	.97	.96	9.99	.11	.10	.05	0.03
42.5—67.5												
47.5—12.5	30.01	9.91	9.99	9.84	30.00	30.05	30.05	9.98	9.99	9.96	9.98	30.02
47.5—17.5	9.96	.88	.97	.88	.00	.08	.07	0.00	0.00	.99	.96	.03
47.5—22.5	.90	.85	.96	.88	.02	.08	.07	9.99	.00	.99	.99	.00
47.5—27.5	.87	.80	.92	.88	.03	.06	.08	.98	.00	.97	.95	9.96
47.5—32.5	.83	.75	.88	.87	.04	.04	.06	.97	.01	.93	.94	.91
47.5—37.5	.80	.77	.84	.84	.04	.01	.03	.98	.01	.90	.92	.89
47.5—42.5	.81	.79	.81	.83	.03	9.97	.01	.98	.01	.91	.92	.88
47.5—47.5	.82	.83	.79	.81	.02	.95	9.97	.96	.04	.94	.92	.88
52.5—12.5	9.92	9.75	9.94	9.81	9.94	9.98	9.92	9.90	9.90	9.90	9.90	9.92
52.5—17.5	.85	.76	.92	.83	.96	.99	.92	.89	.89	.92	.86	.89
52.5—22.5	.79	.71	89	.82	.96	.98	.94	.88	.88	.89	.86	.87
52.5—27.5	.74	.67	.86	.82	.95	.96	.95	.86	.88	.85	.80	.82
52.5—32.5	.72	.67	.81	.79	.96	.93	.94	.87	.88	.83	.82	80
52.5—37.5	.70	.68	.78	.79	.96	.91	.92	.88	.88	.82	.81	.77
52.5—42.5	.72	.70	.76	.78	.96	.89	.92	.88	.90	.84	.81	.76
52.5—47.5	.75	.73	.76	.78	.96	.87	.87	.87	.89	.84	.83	.79
57.5—12.5	29.74	9.67	9.83	9.83	9.90	9.92	9.82	9.80	9.78	9.79	9.74	9.73
57.5—17.5	.70	.61	.82	.81	.90	.90	.81	.80	.75	.74	.73	.71
57.5—22.5	.65	.57	.75	.79	.91	.89	.82	.78	.73	.74	.72	.71

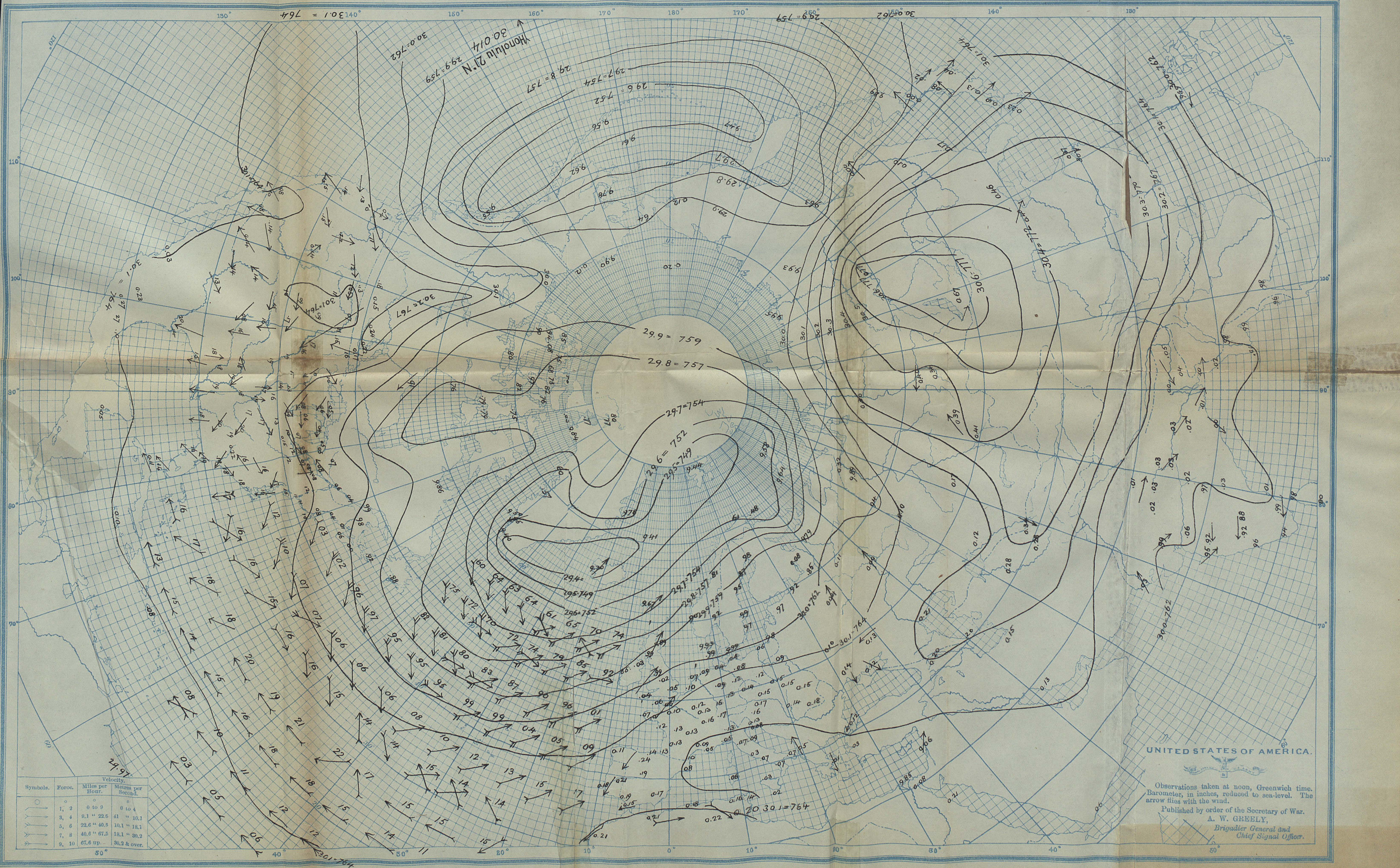
57.5—27.5	.61	.53	.75	.78	.90	.86	.83	.78	.73	.72	.72	.70
57.5—32.5	.64	.53	.71	.79	.90	.85	.83	.79	.73	.71	.72	.69
57.5—37.5	.63	.50	.70	.77	.90	.83	.83	.80	.73	.71	.72	.69
57.5—42.5	.64	.51	.69	.75	.90	.82	.81	.81	.73	.72	.72	.69
57.5—47.5	.60	.57	.69	.75	.89	.82	.81	.81	.74	.71	.72	.69

INDEX.

MEAN BAROMETRIC PRESSURE AND PREVAILING WINDS, AS DETERMINED FROM INTERNATIONAL METEOROLOGICAL OBSERVATIONS, AT NOON (GREENWICH TIME), 1878-1887.

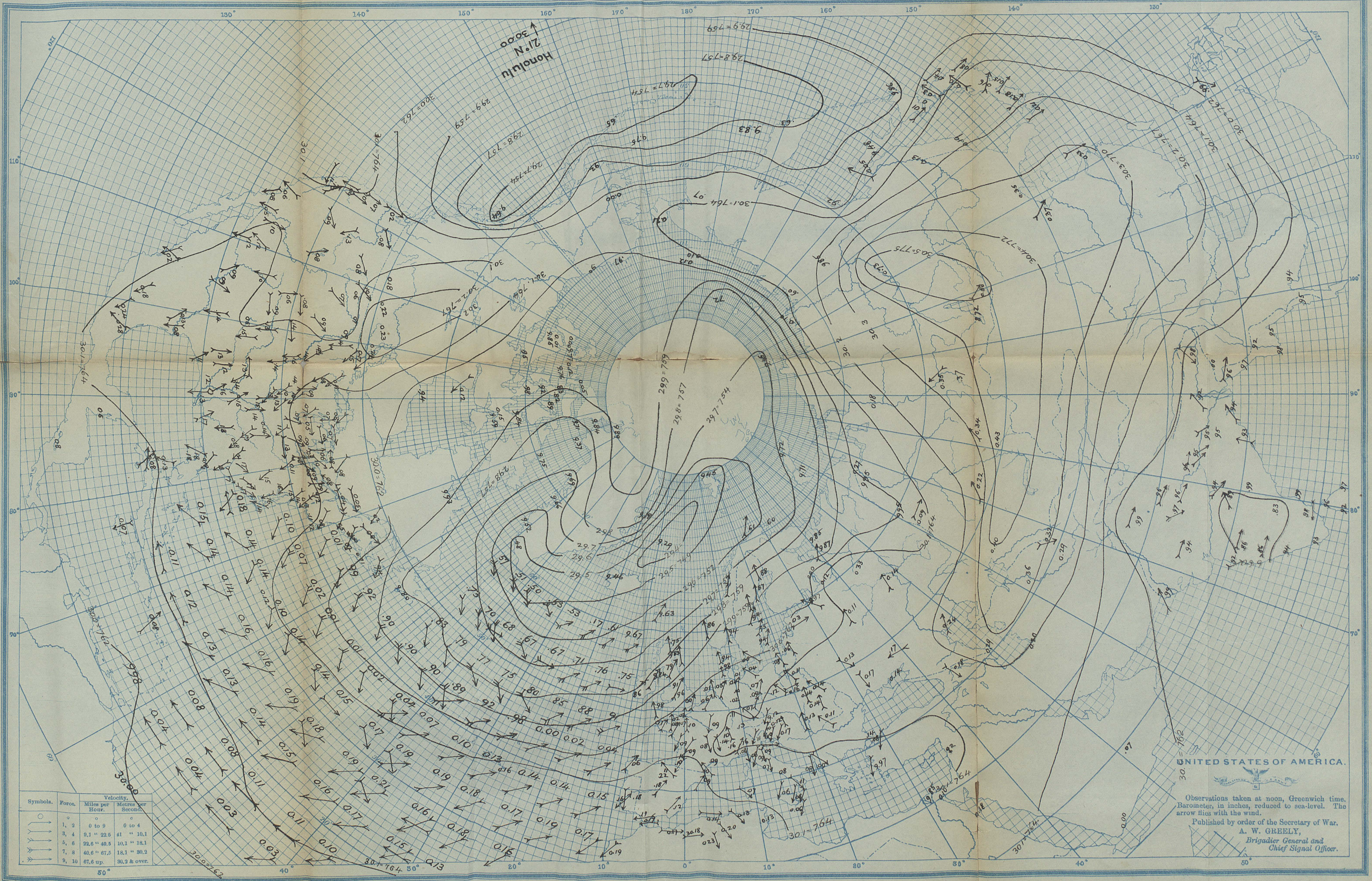
JANUARY

Chart No. 1—Appendix 17.
Chief Signal Officer.



MEAN BAROMETRIC PRESSURE AND PREVAILING WINDS, AS DETERMINED FROM INTERNATIONAL METEOROLOGICAL OBSERVATIONS, AT NOON (GREENWICH TIME), 1878-1887.

FEBRUARY



Symbols.	Force.	Velocity. Miles per Hour.	Velocity. Metres per Second.
○	0	0	0
	1, 2	0 to 9	0 to 4
	3, 4	9.1 " 22.5	41 " 10.1
	5, 6	22.6 " 40.5	10.1 " 18.1
	7, 8	40.6 " 67.5	18.1 " 30.2
	9, 10	67.6 up.	30.2 & over.

Observations taken at noon, Greenwich time. Barometer, in inches, reduced to sea-level. The arrow flies with the wind.

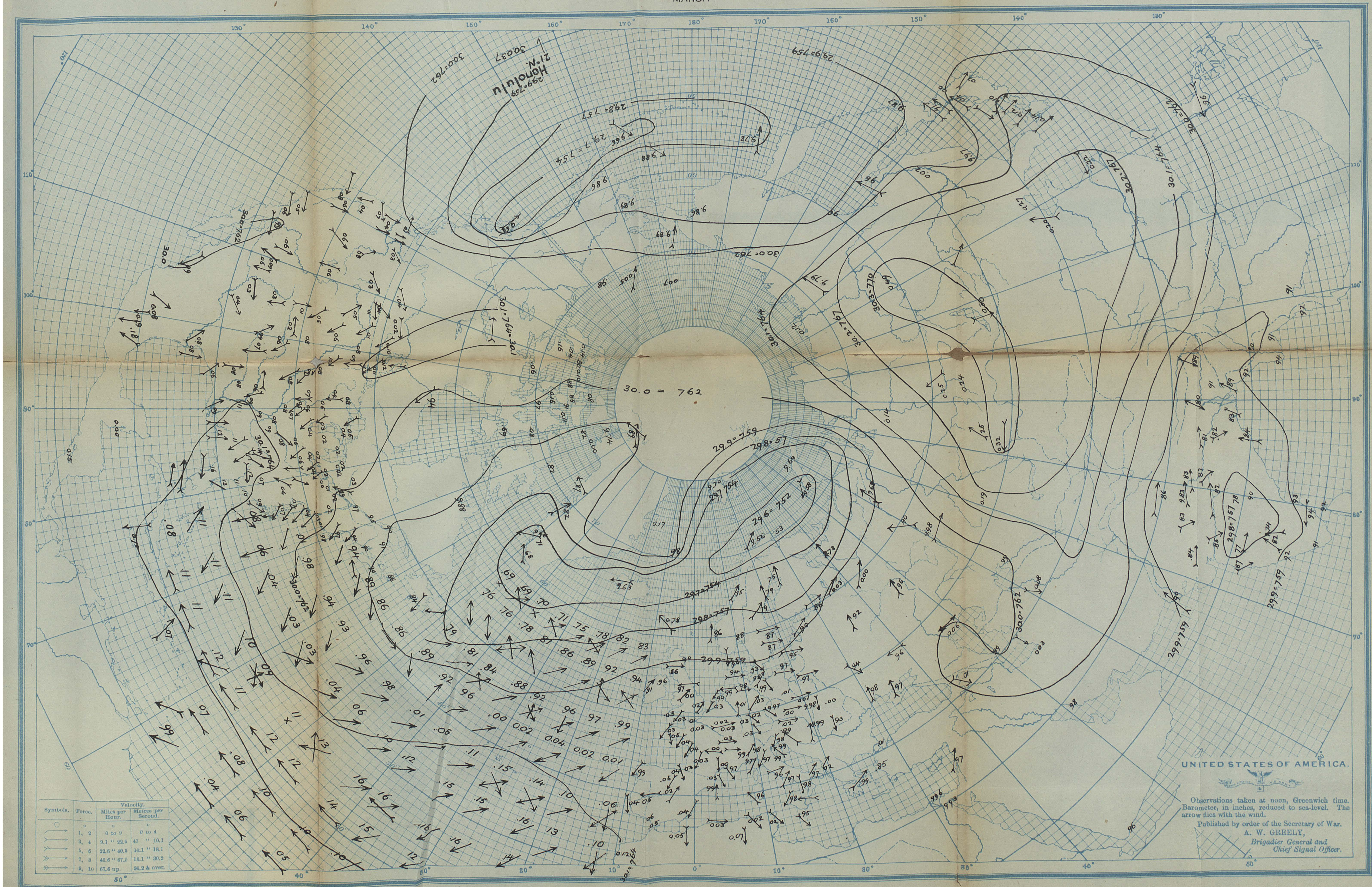
Published by order of the Secretary of War.

A. W. GREELY,
Brigadier General and
Chief Signal Officer.

MEAN BAROMETRIC PRESSURE AND PREVAILING WINDS, AS DETERMINED FROM INTERNATIONAL METEOROLOGICAL OBSERVATIONS, AT NOON (GREENWICH TIME), 1878-1887.

MARCH

Chart No. 3—Appendix 17.
Chief Signal Officer.

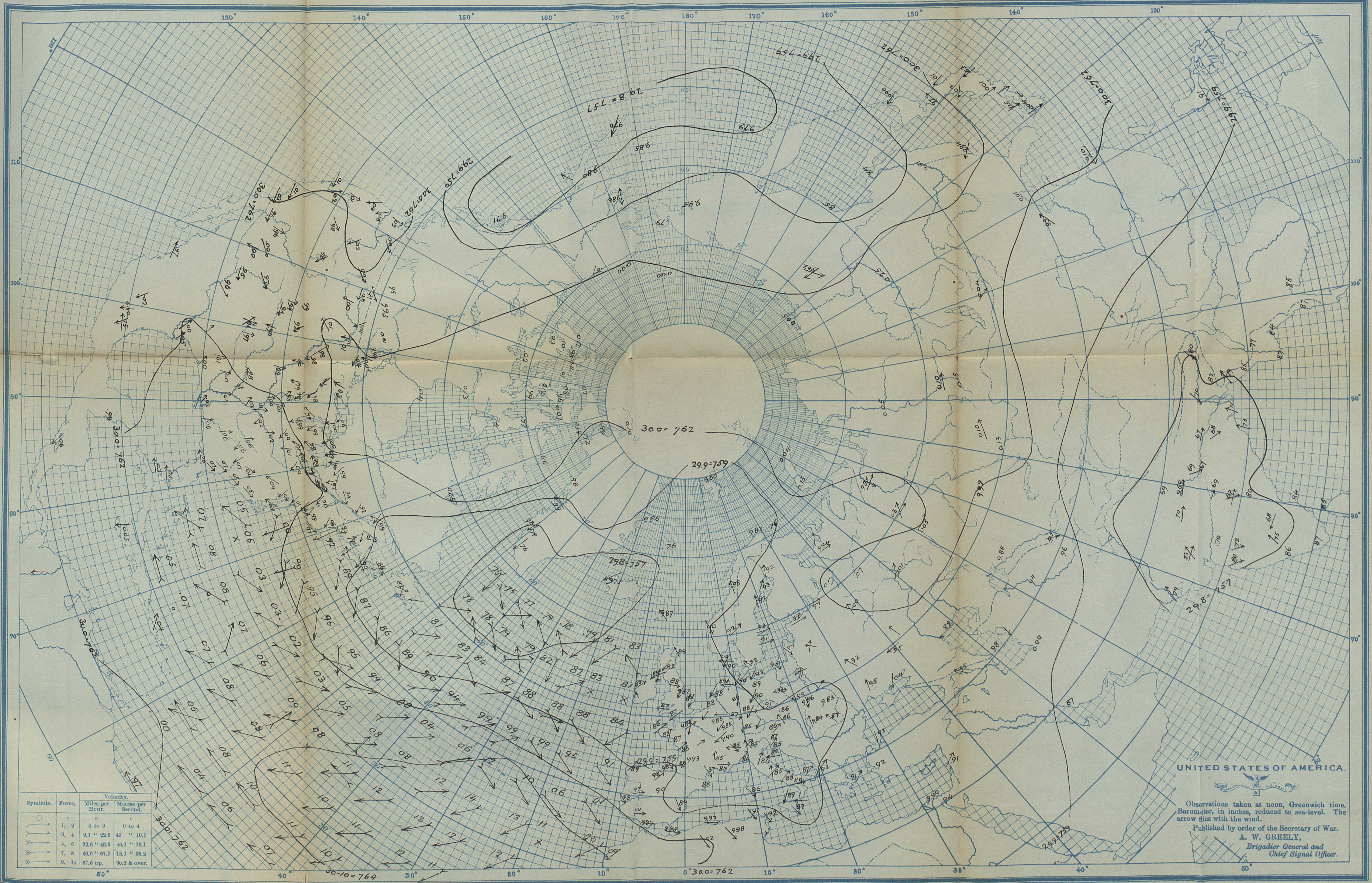


Symbols.	Force.	Velocity. Miles per Hour.	Velocity. Metres per Second.
○	0	0	0
→	1, 2	0 to 9	0 to 4
→	3, 4	9.1 " 22.5	41 " 10.1
→	5, 6	22.6 " 40.5	10.1 " 18.1
→	7, 8	40.6 " 67.5	18.1 " 30.2
→	9, 10	67.6 up.	30.2 & over.

MEAN BAROMETRIC PRESSURE AND PREVAILING WINDS, AS DETERMINED FROM INTERNATIONAL METEOROLOGICAL OBSERVATIONS, AT NOON (GREENWICH TIME), 1878-1887.

APRIL

Chart No. 4 —Appendix 17.
Chief Signal Officer.



Symbols.	Force.	Velocity.	
		Miles per Hour.	Metres per Second.
○	○	○	○
	1, 2	0 to 9	0 to 4
	3, 4	9.1 " 22.5	41 " 10.1
	5, 6	22.6 " 40.5	10.1 " 18.1
	7, 8	40.6 " 67.5	18.1 " 30.2
	9, 10	67.6 up.	30.2 & over.

Observations taken at noon, Greenwich time. Barometer, in inches, reduced to sea-level. The arrow flies with the wind.

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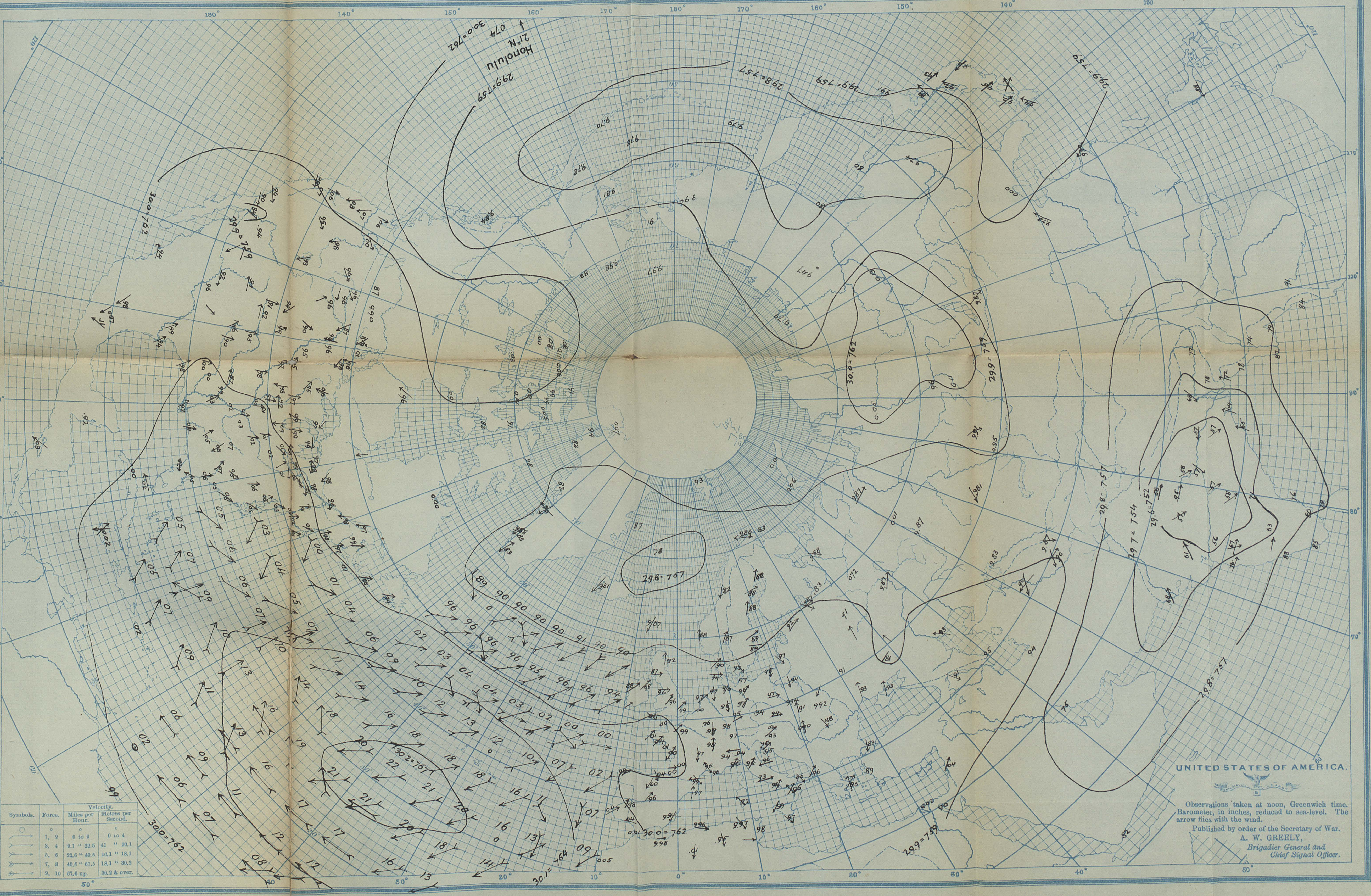
MEAN BAROMETRIC PRESSURE AND PREVAILING WINDS, AS DETERMINED FROM INTERNATIONAL METEOROLOGICAL OBSERVATIONS, AT NOON (GREENWICH TIME), 1878-1887.

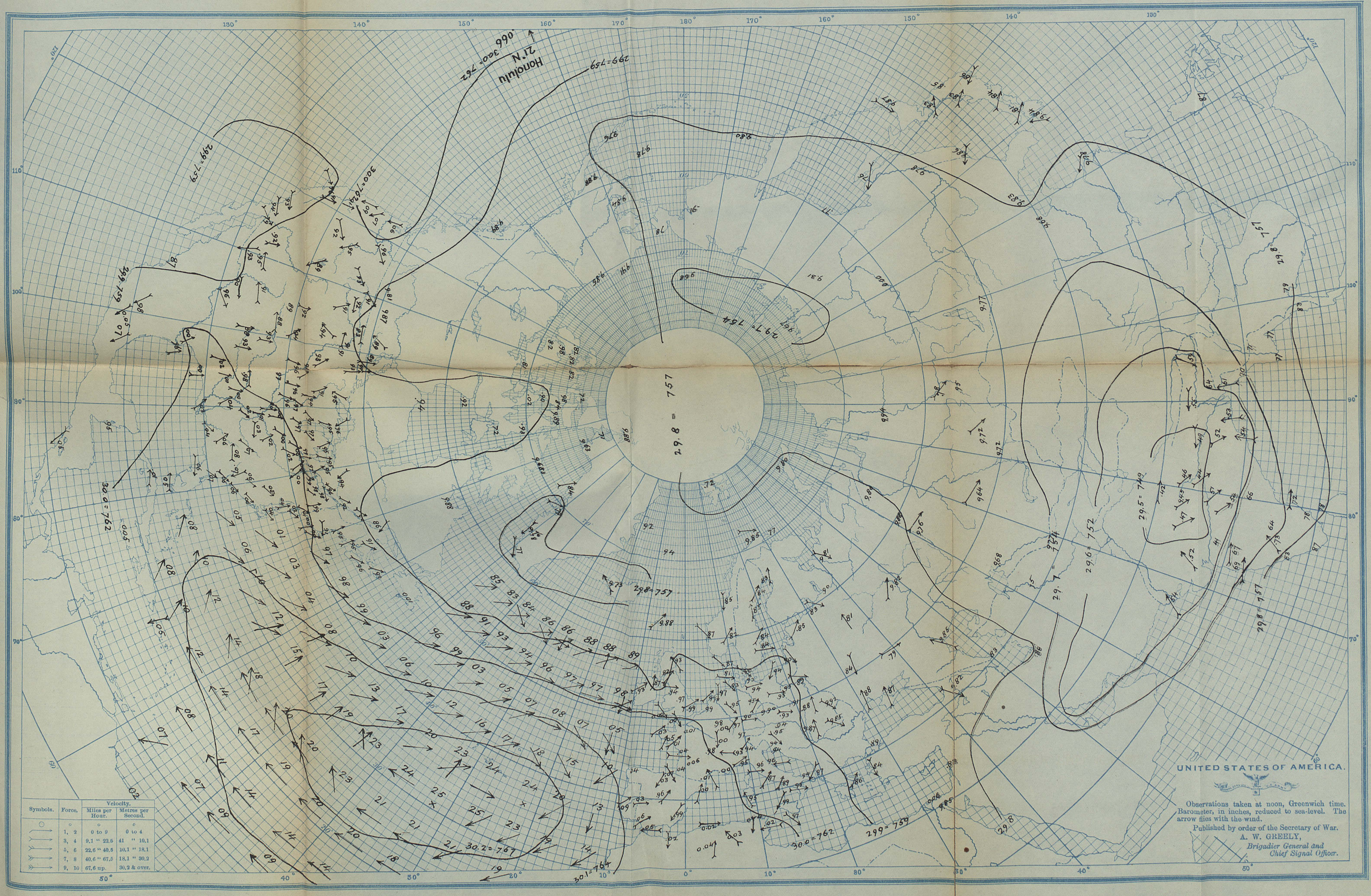
MAY



MEAN BAROMETRIC PRESSURE AND PREVAILING WINDS, AS DETERMINED FROM INTERNATIONAL METEOROLOGICAL OBSERVATIONS, AT NOON (GREENWICH TIME), 1878-1887.

JUNE

Chart No 6 —Appendix 17.
Chief Signal Officer.



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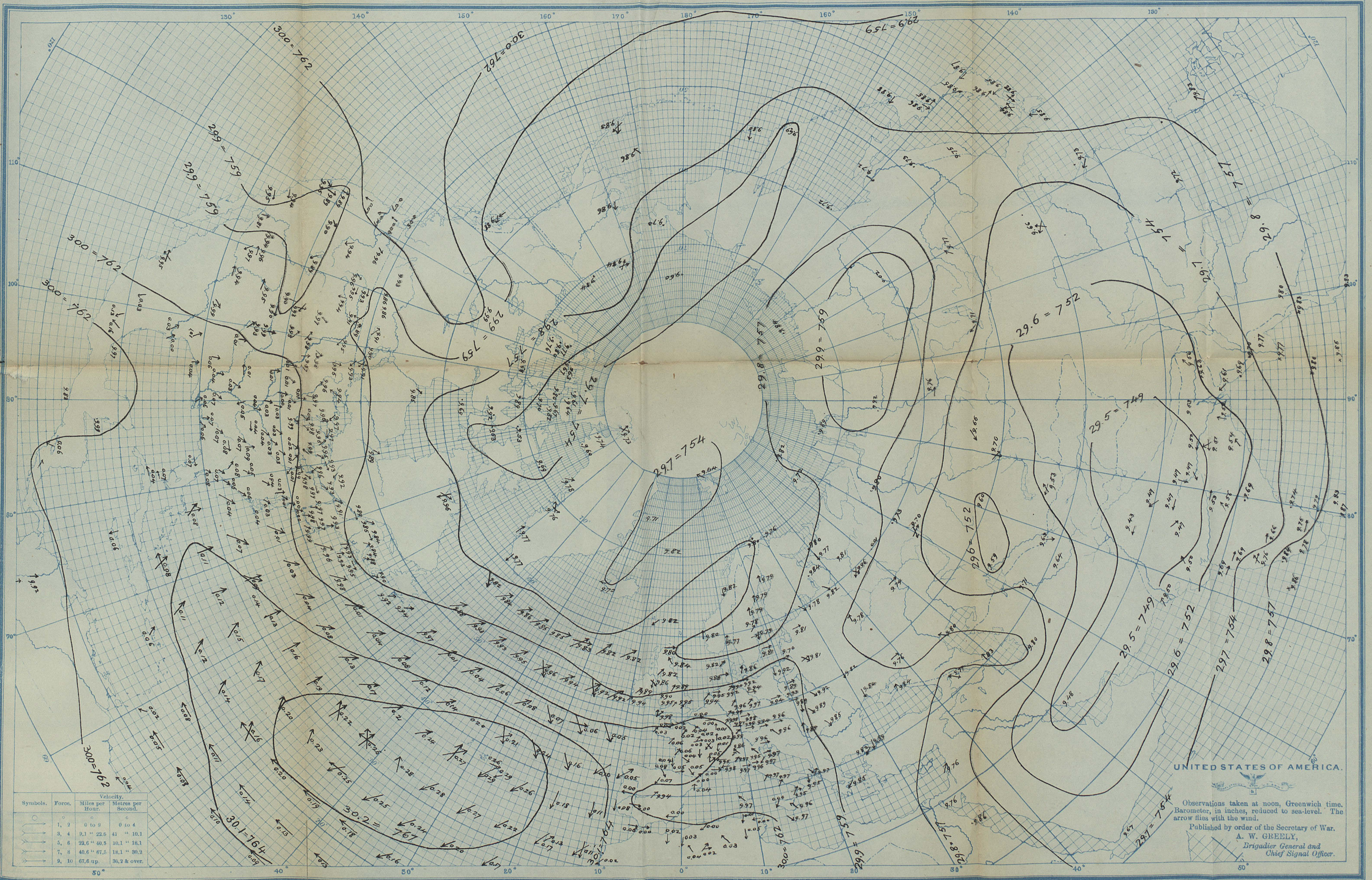
MEAN BAROMETRIC PRESSURE AND PREVAILING WINDS, AS DETERMINED FROM INTERNATIONAL METEOROLOGICAL OBSERVATIONS, AT NOON (GREENWICH TIME), 1878-1887.

JULY

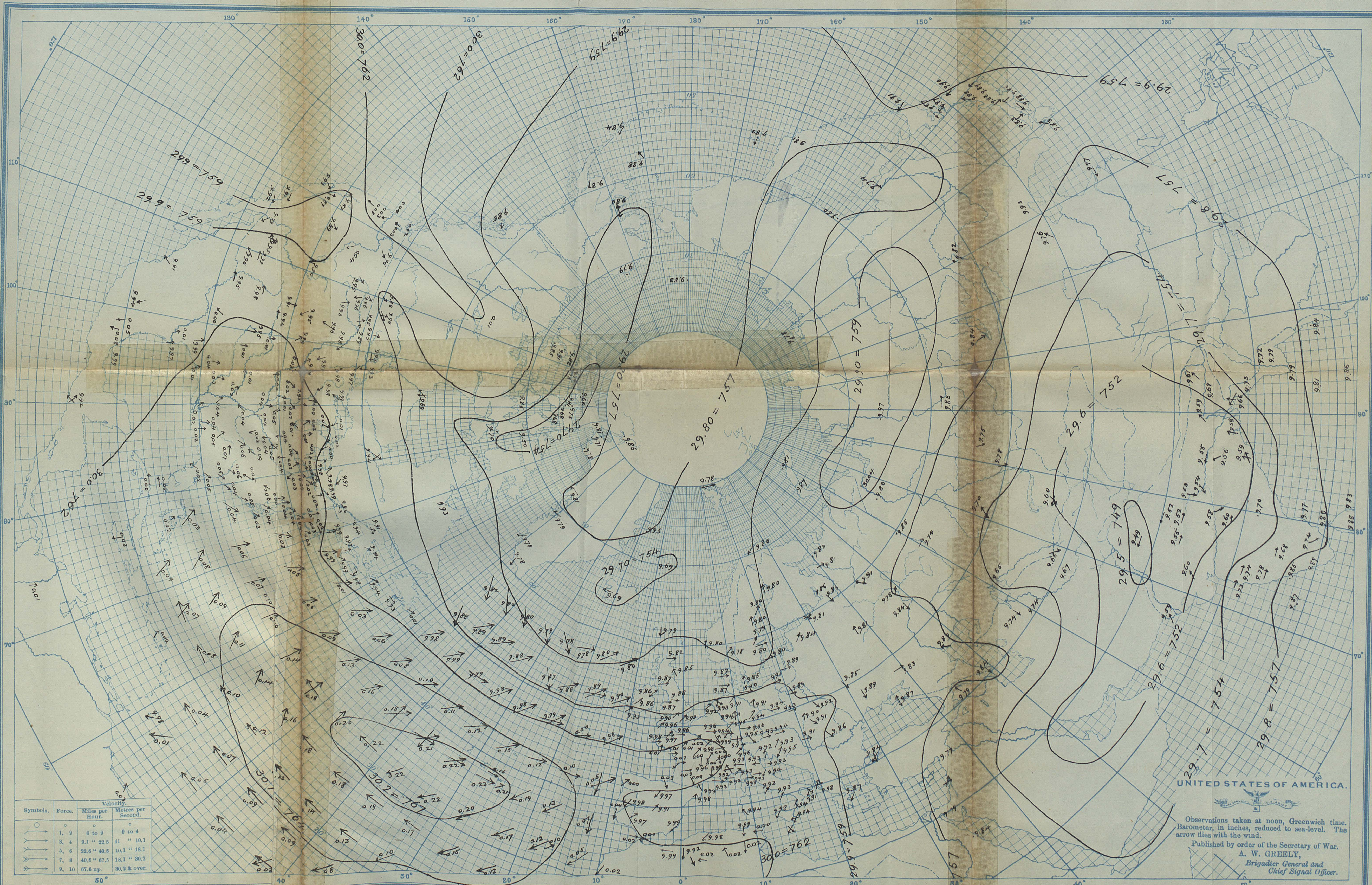
Chart No. 7.—Appendix 17.
Chief Signal Officer.



Symbols.	Force.	Velocity. Miles per Hour.	Velocity. Metres per Second.
○	0	0	0
	1, 2	0 to 9	0 to 4
	3, 4	9.1 " 22.5	41 " 10.1
	5, 6	22.6 " 40.5	10.1 " 18.1
	7, 8	40.6 " 67.5	18.1 " 30.2
	9, 10	67.6 up.	30.2 & over.

MEAN BAROMETRIC PRESSURE AND PREVAILING WINDS, AS DETERMINED FROM INTERNATIONAL METEOROLOGICAL OBSERVATIONS, AT NOON (GREENWICH TIME), 1878-1887.
AUGUST

Chart No. 8 –Appendix 17.
Chief Signal Officer.



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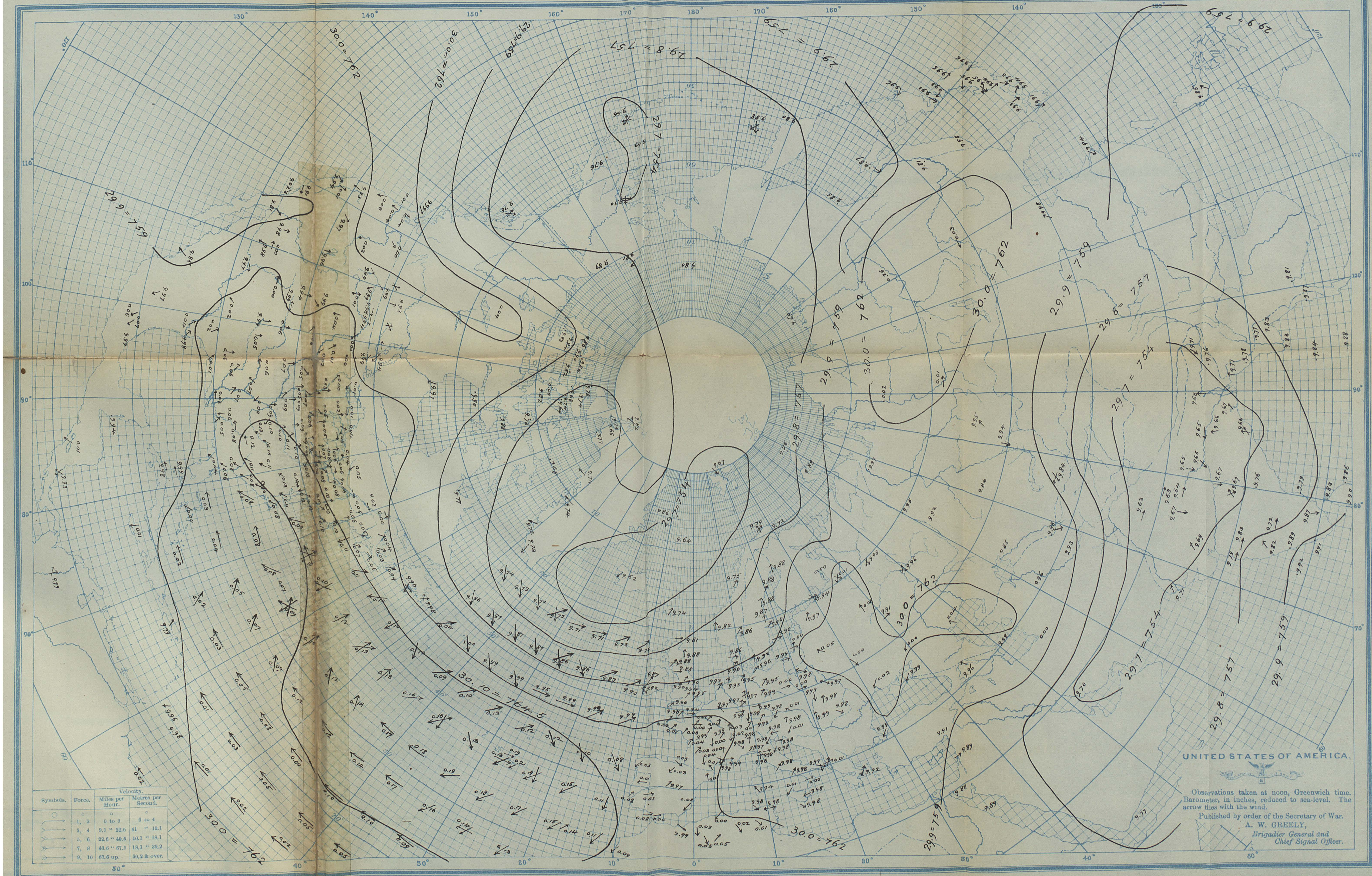
MEAN BAROMETRIC PRESSURE AND PREVAILING WINDS, AS DETERMINED FROM INTERNATIONAL METEOROLOGICAL OBSERVATIONS, AT NOON (GREENWICH TIME), 1878-1887.

SEPTEMBER

Chart No. 9 –Appendix 17.
Chief Signal Officer.



Symbols.	Force.	Velocity. Miles per Hour.	Velocity. Metres per Second.
○	0	0	0
	1, 2	0 to 9	0 to 4
	3, 4	9.1 " 22.5	41 " 10.1
	5, 6	22.6 " 40.5	10.1 " 18.1
	7, 8	40.6 " 67.5	18.1 " 30.2
	9, 10	67.6 up.	30.2 & over.

Observations taken at noon, Greenwich time. Barometer, in inches, reduced to sea-level. The arrow flies with the wind.

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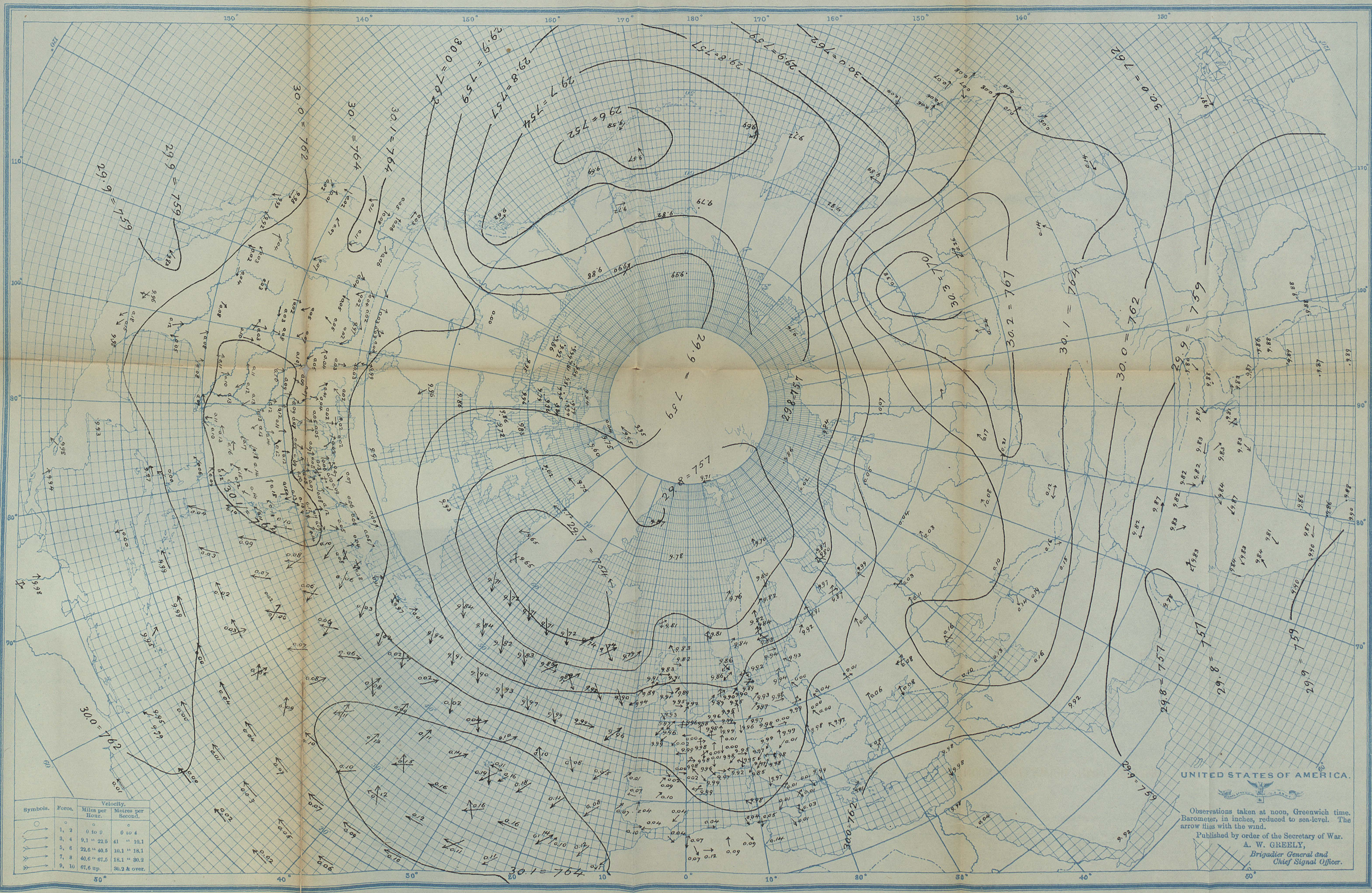
MEAN BAROMETRIC PRESSURE AND PREVAILING WINDS, AS DETERMINED FROM INTERNATIONAL METEOROLOGICAL OBSERVATIONS, AT NOON (GREENWICH TIME), 1878-1887.

OCTOBER

Chart No. 10–Appendix 17.
Chief Signal Officer.



Symbols.	Force.	Velocity. Miles per Hour.	Velocity. Metres per Second.
	0	0	0
	1, 2	0 to 9	0 to 4
	3, 4	9.1 " 22.5	41 " 10.1
	5, 6	22.6 " 40.5	10.1 " 18.1
	7, 8	40.6 " 67.5	18.1 " 30.2
	9, 10	67.6 up.	30.2 & over.

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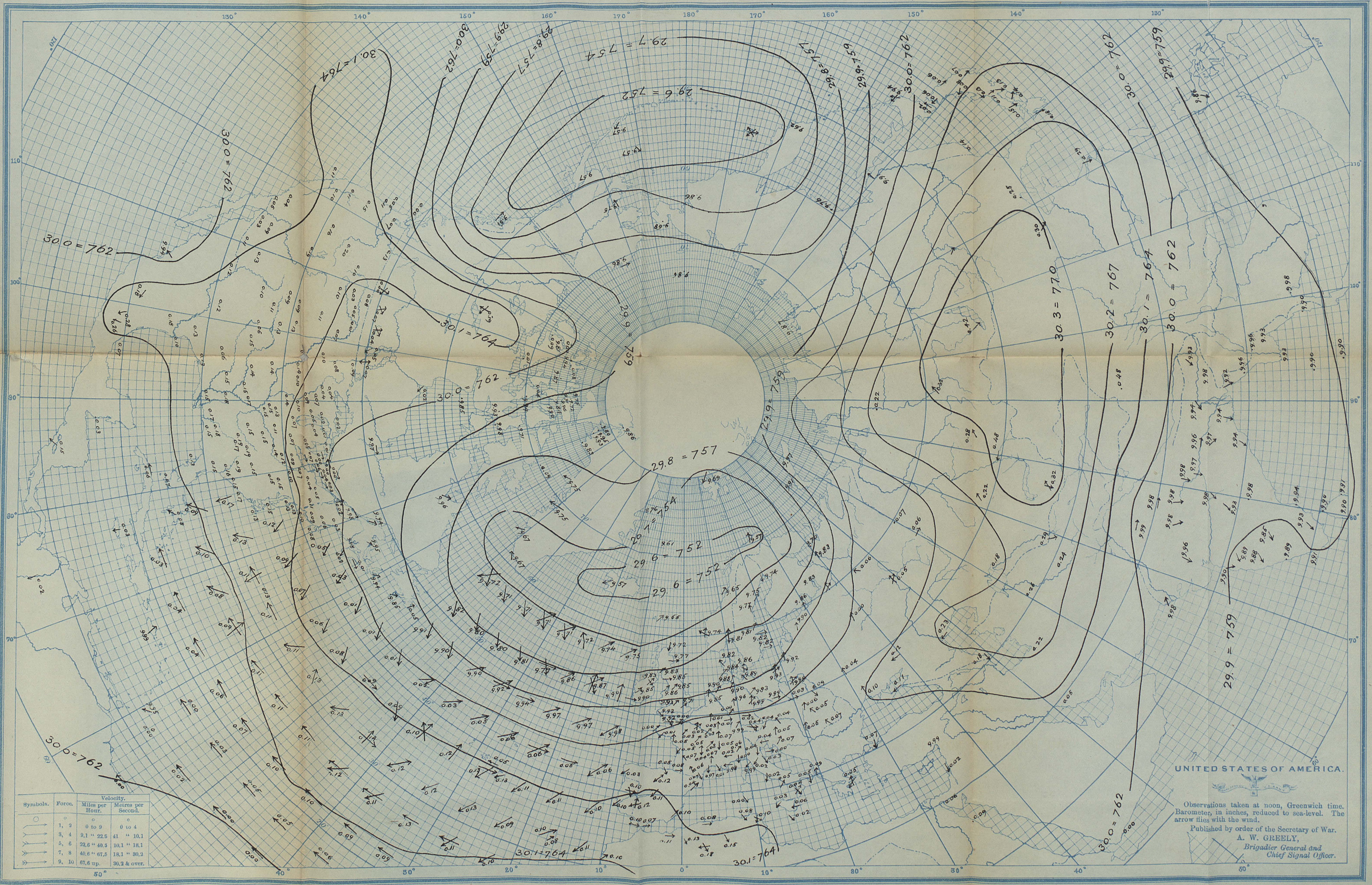
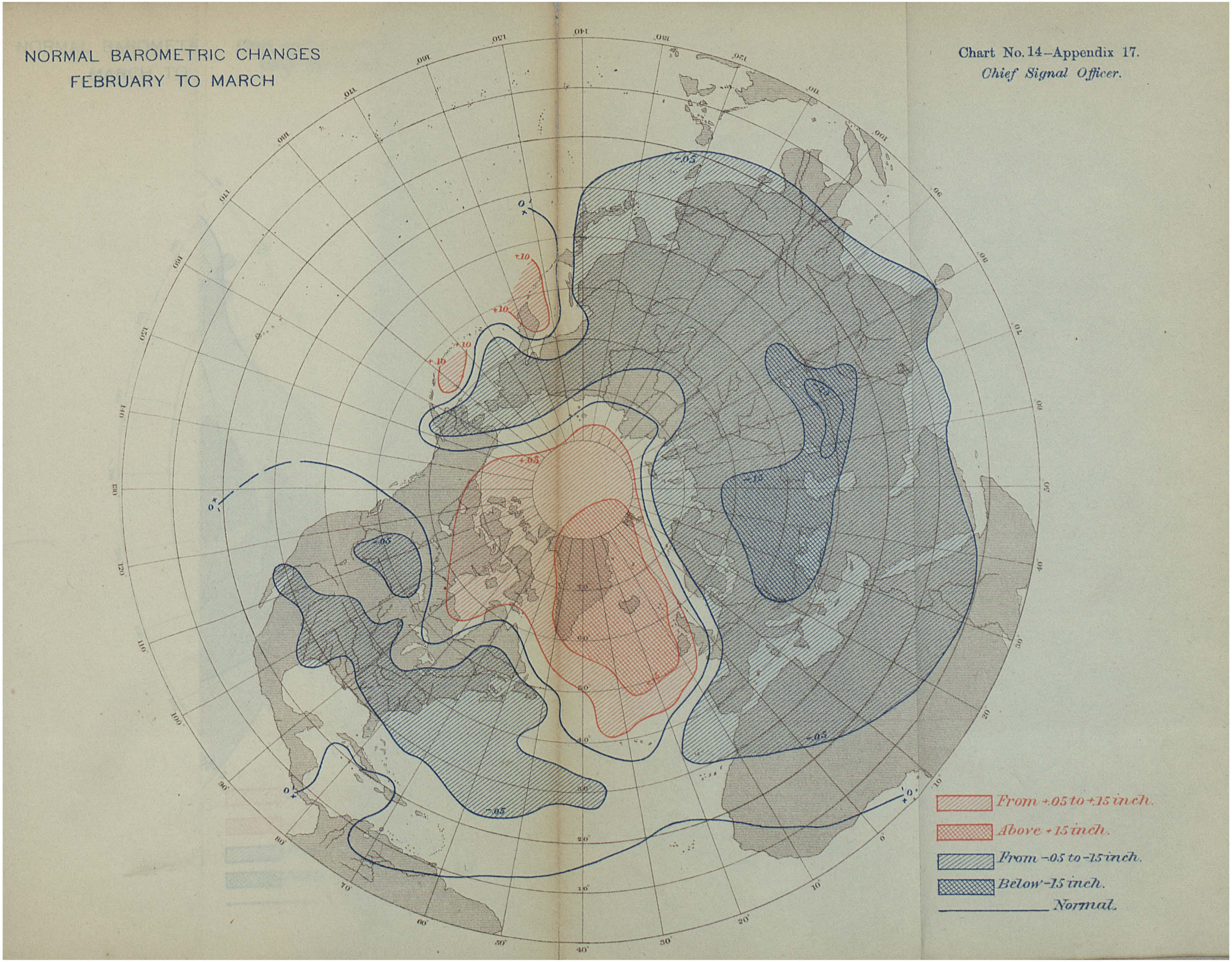
MEAN BAROMETRIC PRESSURE AND PREVAILING WINDS, AS DETERMINED FROM INTERNATIONAL METEOROLOGICAL OBSERVATIONS, AT NOON (GREENWICH TIME), 1878-1887.

NOVEMBER

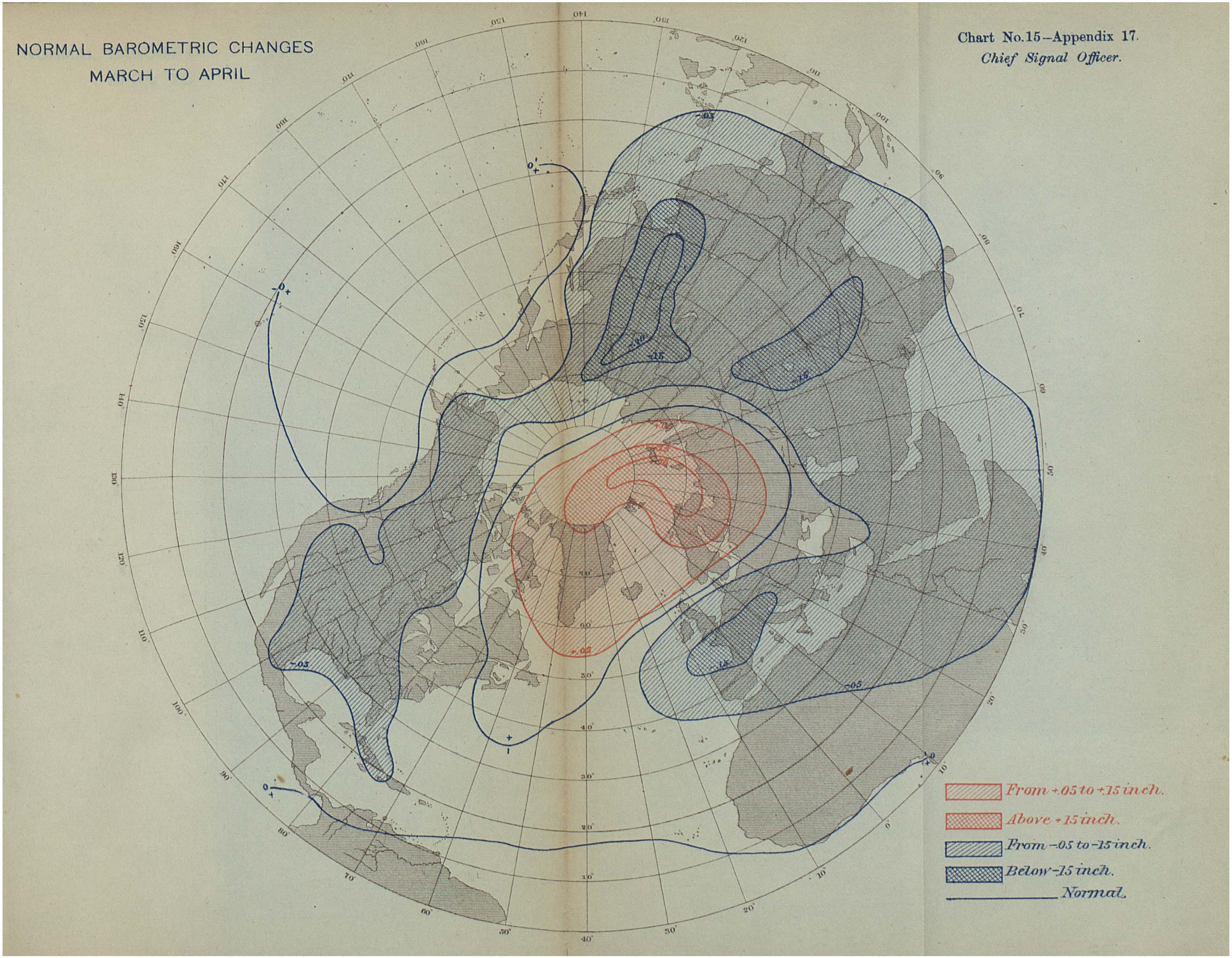
Chart No. 11—Appendix 17.
Chief Signal Officer.



Symbols.	Force.	Velocity. Miles per Hour.	Velocity. Metres per Second.
○	0	0	0
	1, 2	0 to 9	0 to 4
	3, 4	9.1 " 22.5	41 " 10.1
	5, 6	22.6 " 40.5	10.1 " 18.1
	7, 8	40.6 " 67.5	18.1 " 30.2
	9, 10	67.6 up.	30.2 & over.

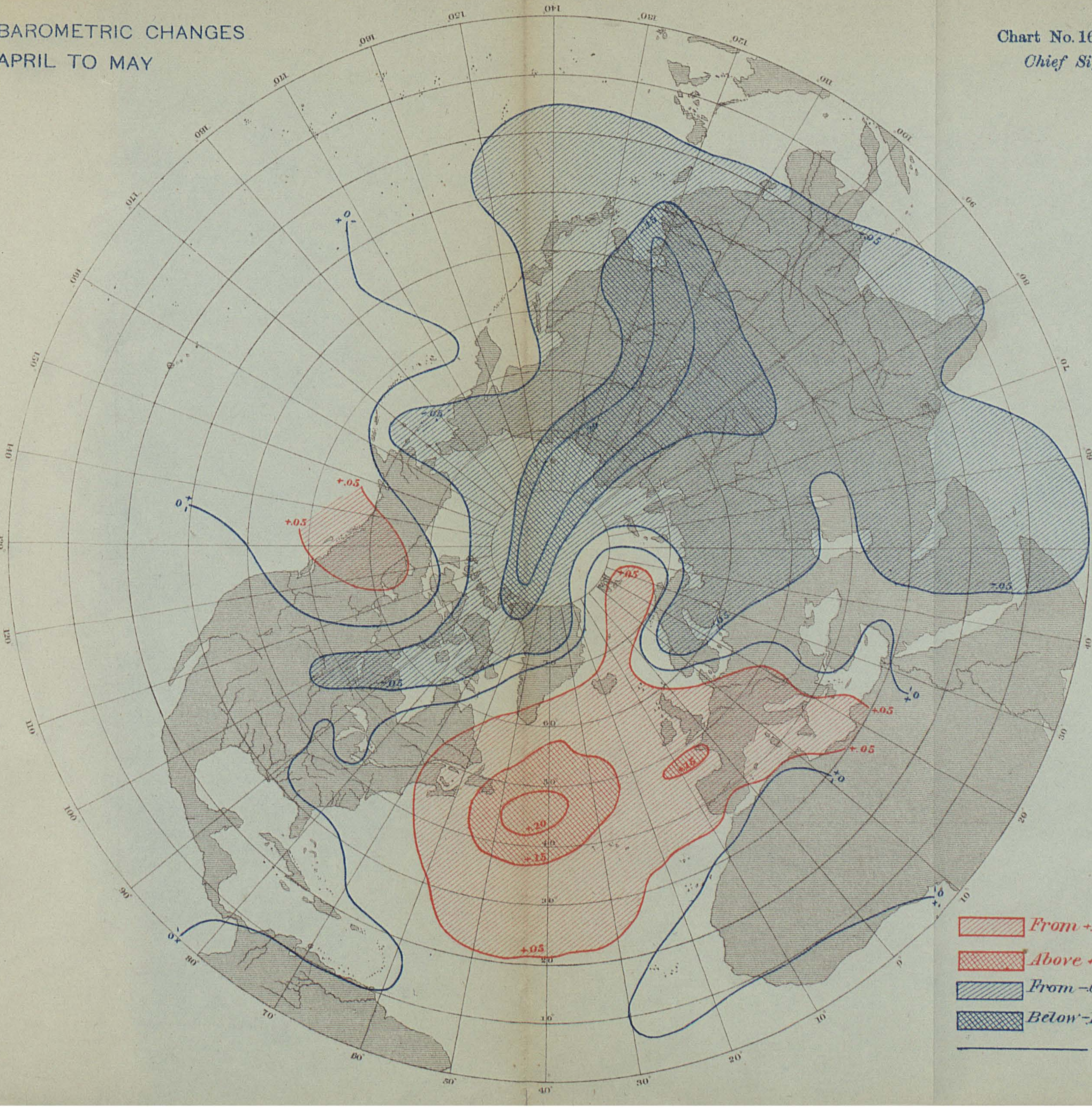


NORMAL BAROMETRIC CHANGES
FEBRUARY TO MARCH
Chart No. 14–Appendix 17.
Chief Signal Officer.
From +.05 to +.15 inch.
Above +.15 inch.
From −.05 to −.15 inch.
Below −.15 inch.
Normal.


NORMAL BAROMETRIC CHANGES
MARCH TO APRIL
Chart No. 15 – Appendix 17.
Chief Signal Officer.
From +.05 to +.15 inch.
Above +.15 inch.
From –.05 to –.15 inch.
Below –.15 inch.
Normal.

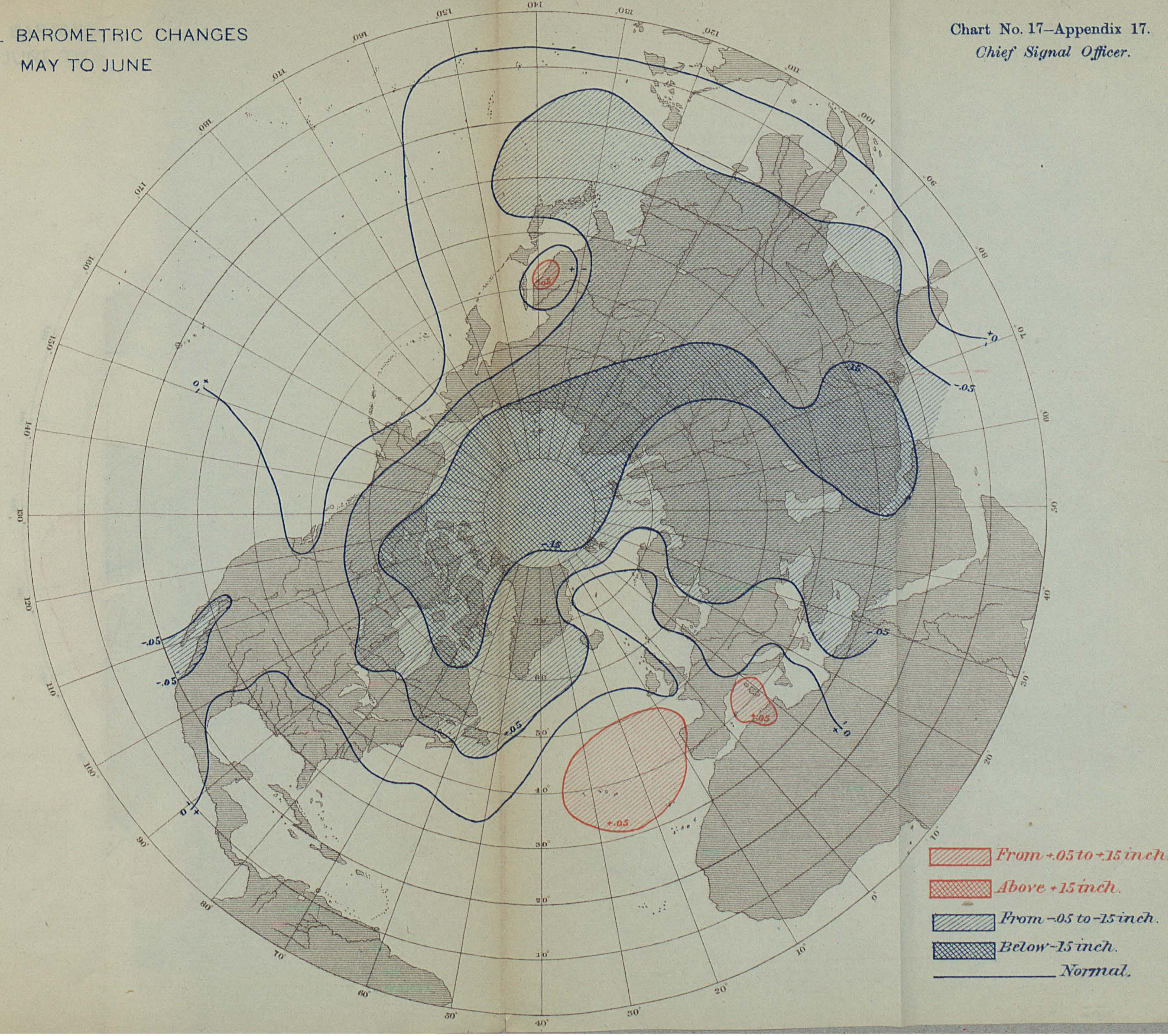
NORMAL BAROMETRIC CHANGES
APRIL TO MAY

Chart No. 16 - Appendix 17.
Chief Signal Officer.



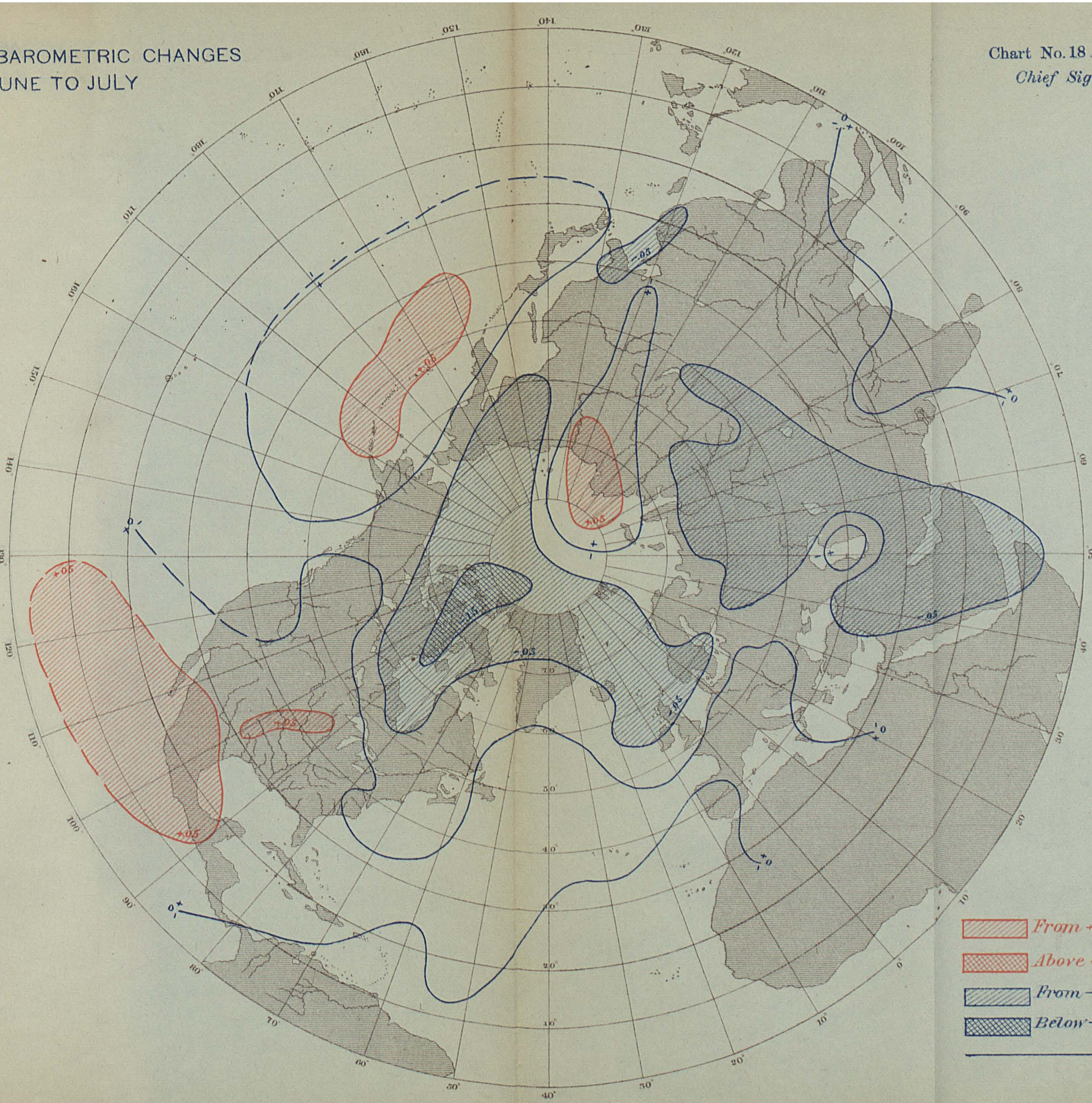
NORMAL BAROMETRIC CHANGES
MAY TO JUNE

Chart No. 17–Appendix 17.
Chief Signal Officer.



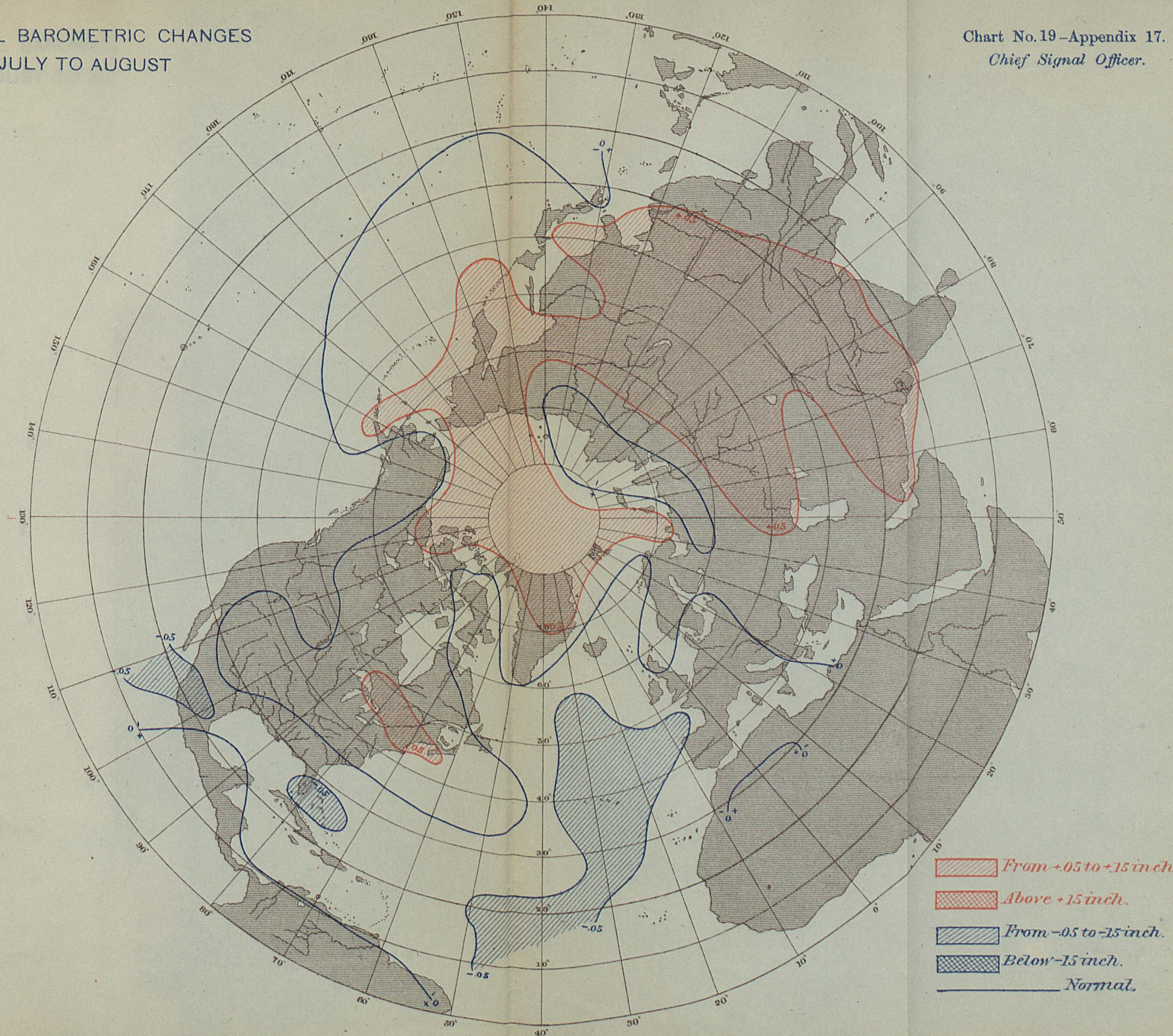
NORMAL BAROMETRIC CHANGES
JUNE TO JULY

Chart No. 18 - Appendix 17.
Chief Signal Officer.



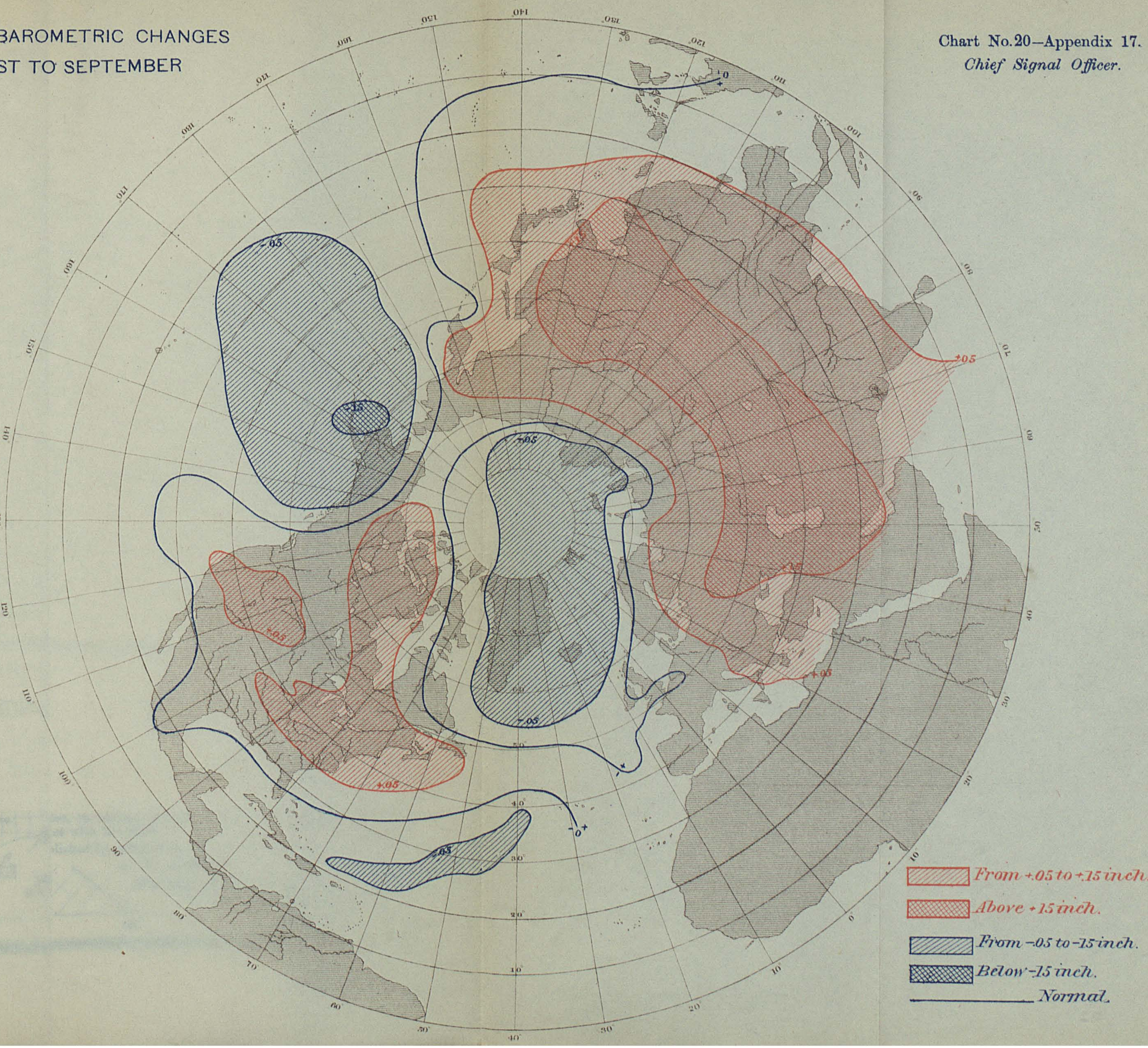
NORMAL BAROMETRIC CHANGES
JULY TO AUGUST

Chart No. 19 – Appendix 17.
Chief Signal Officer.



NORMAL BAROMETRIC CHANGES
AUGUST TO SEPTEMBER

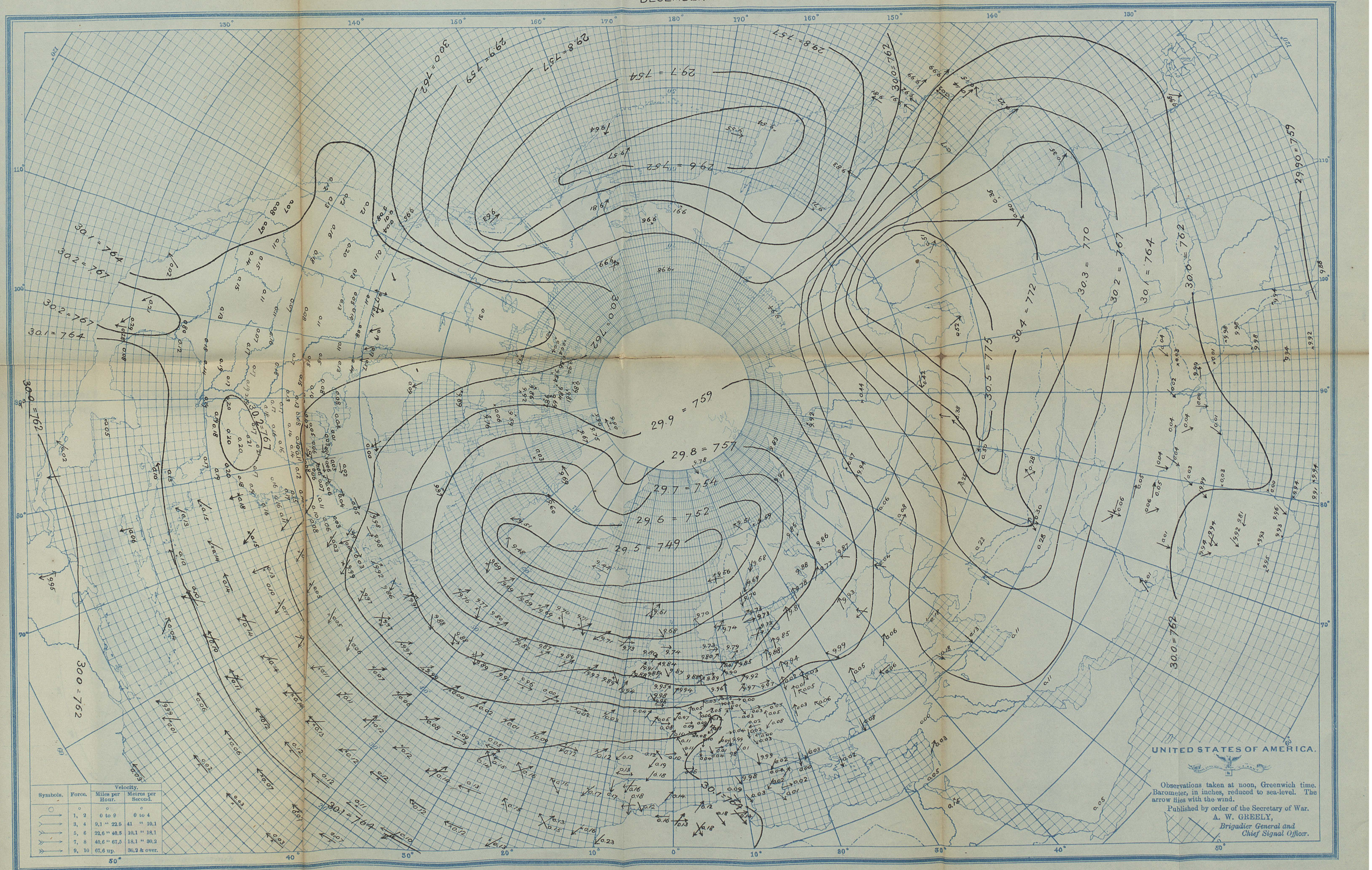
Chart No. 20—Appendix 17.
Chief Signal Officer.



MEAN BAROMETRIC PRESSURE AND PREVAILING WINDS, AS DETERMINED FROM INTERNATIONAL METEOROLOGICAL OBSERVATIONS, AT NOON (GREENWICH TIME), 1878-1887.

DECEMBER

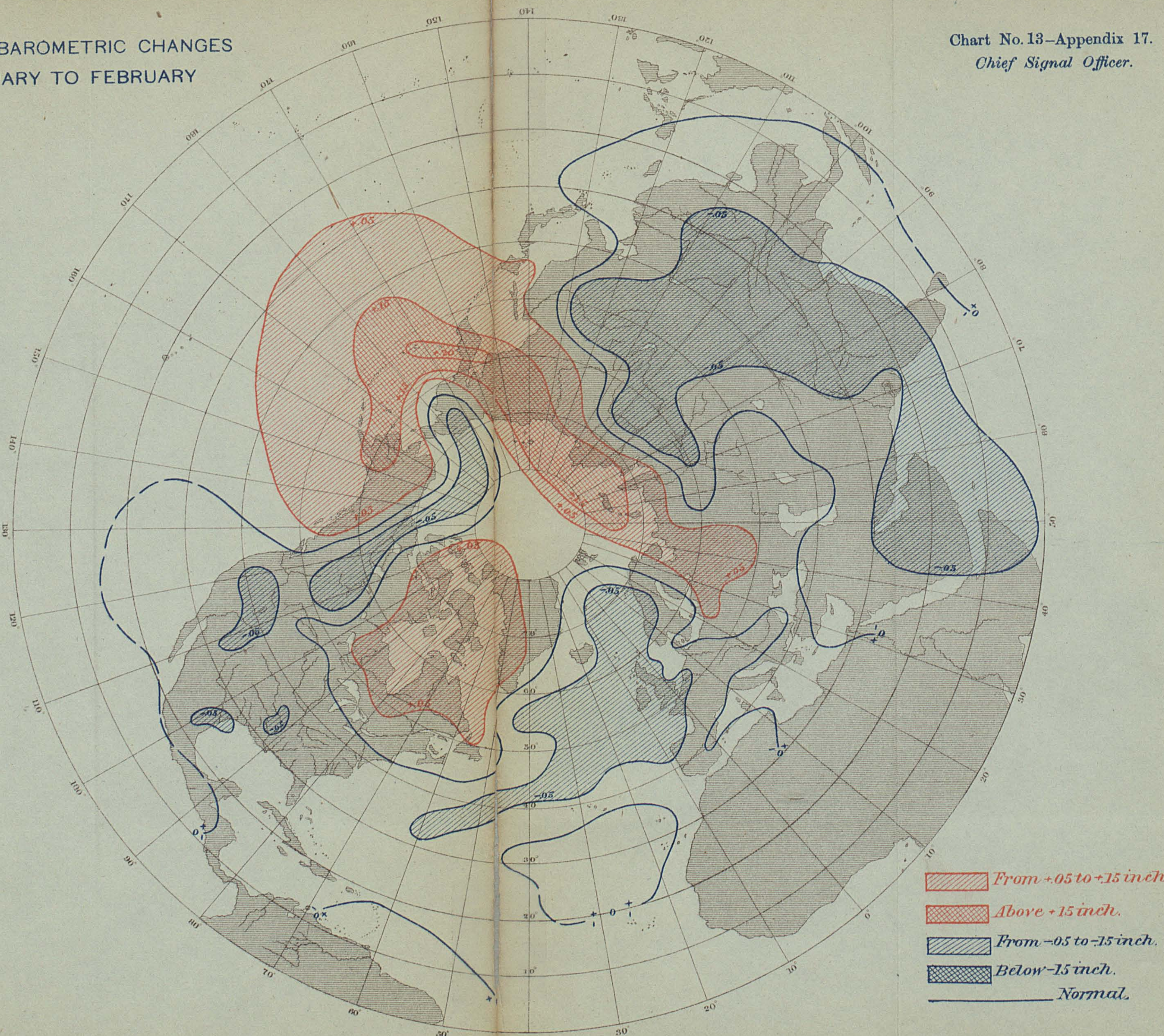
Chart No. 12 - Appendix 17.
Chief Signal Officer.



Symbols.	Force.	Velocity. Miles per Hour.	Velocity. Metres per Second.
○	0	0	0
	1, 2	0 to 9	0 to 4
	3, 4	9.1 " 22.5	41 " 10.1
	5, 6	22.6 " 40.5	10.1 " 18.1
	7, 8	40.6 " 67.5	18.1 " 30.2
	9, 10	67.6 up.	30.2 & over.

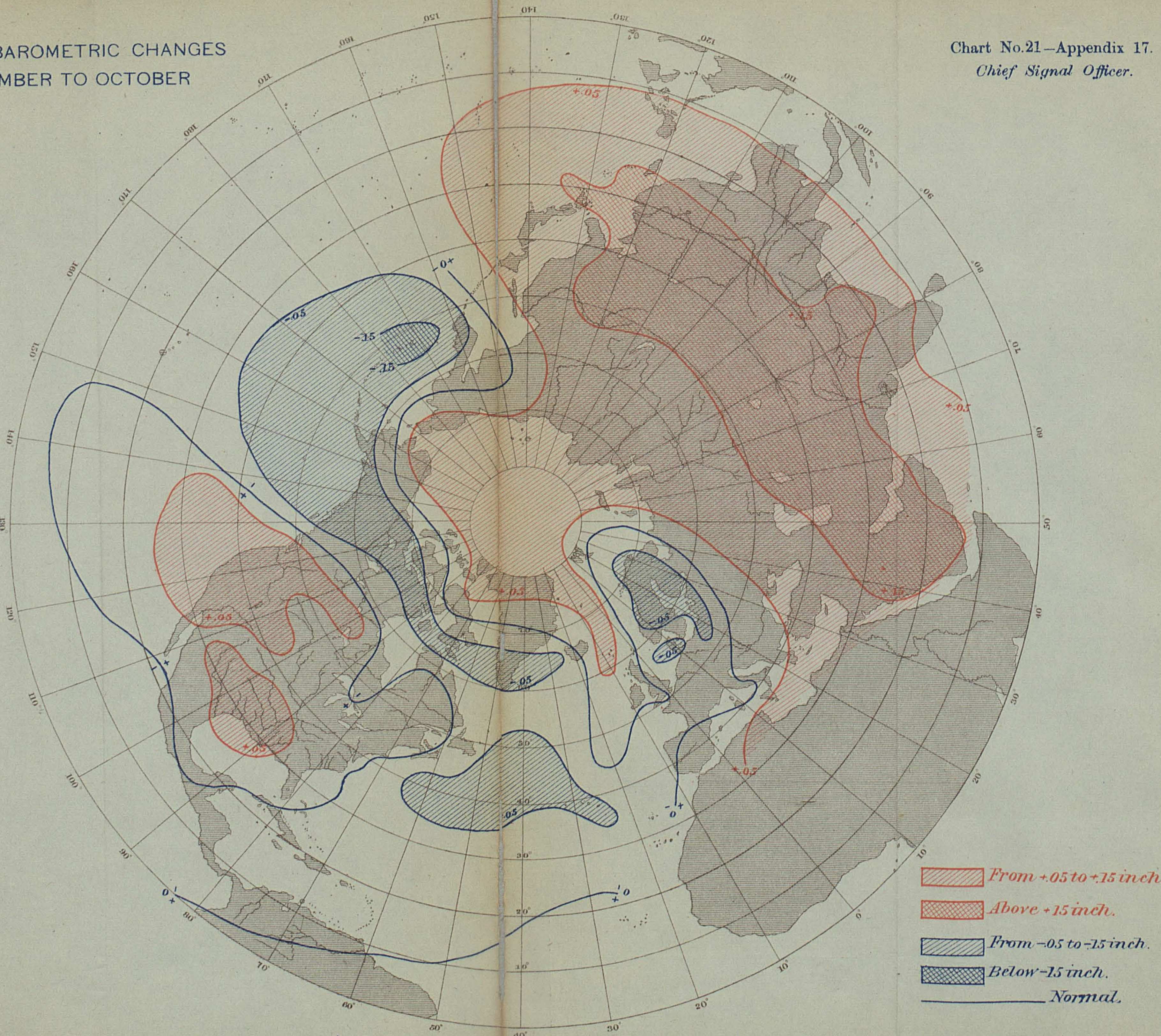
NORMAL BAROMETRIC CHANGES
JANUARY TO FEBRUARY

Chart No. 13–Appendix 17.
Chief Signal Officer.



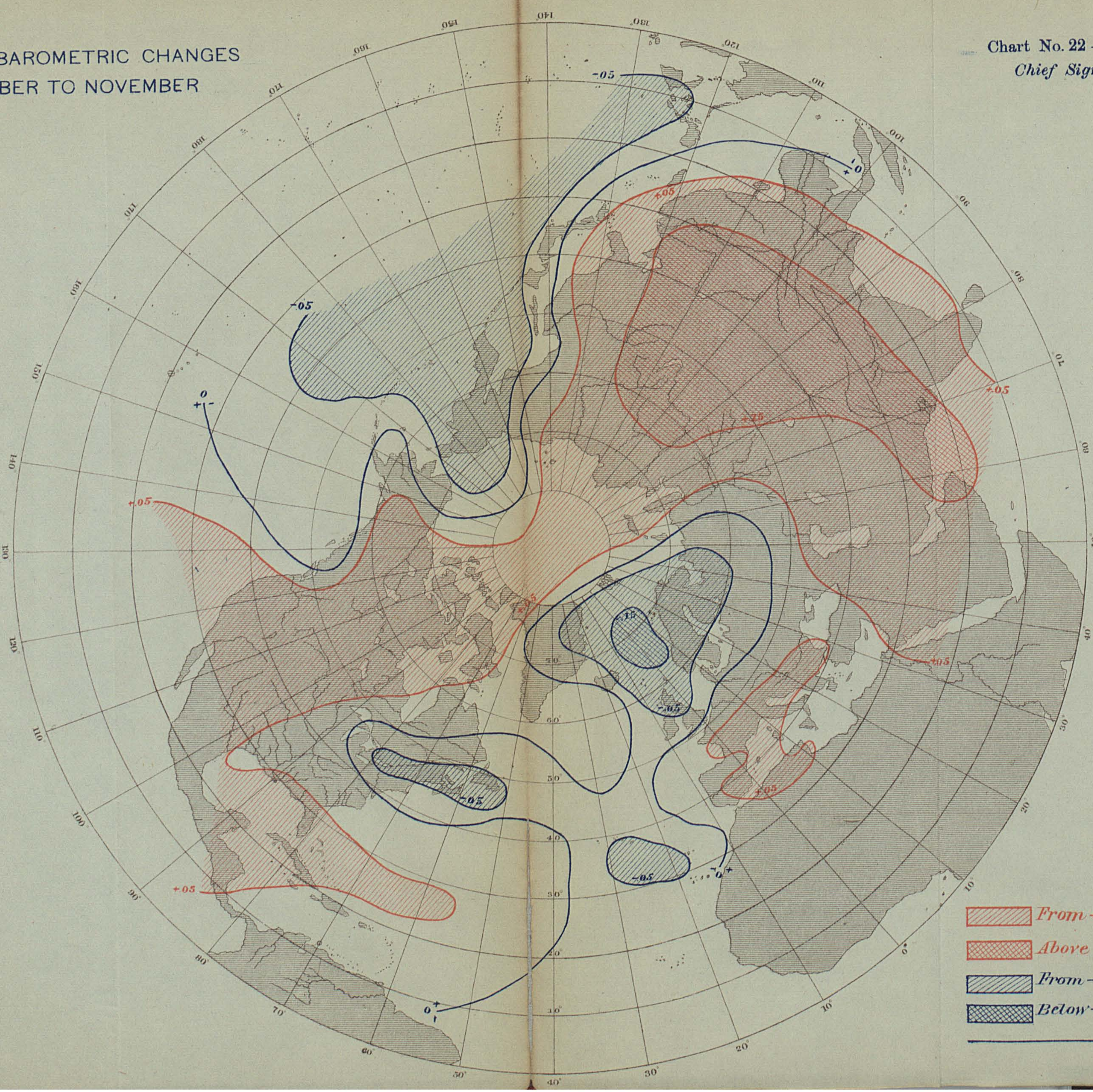
NORMAL BAROMETRIC CHANGES
SEPTEMBER TO OCTOBER

Chart No. 21—Appendix 17.
Chief Signal Officer.



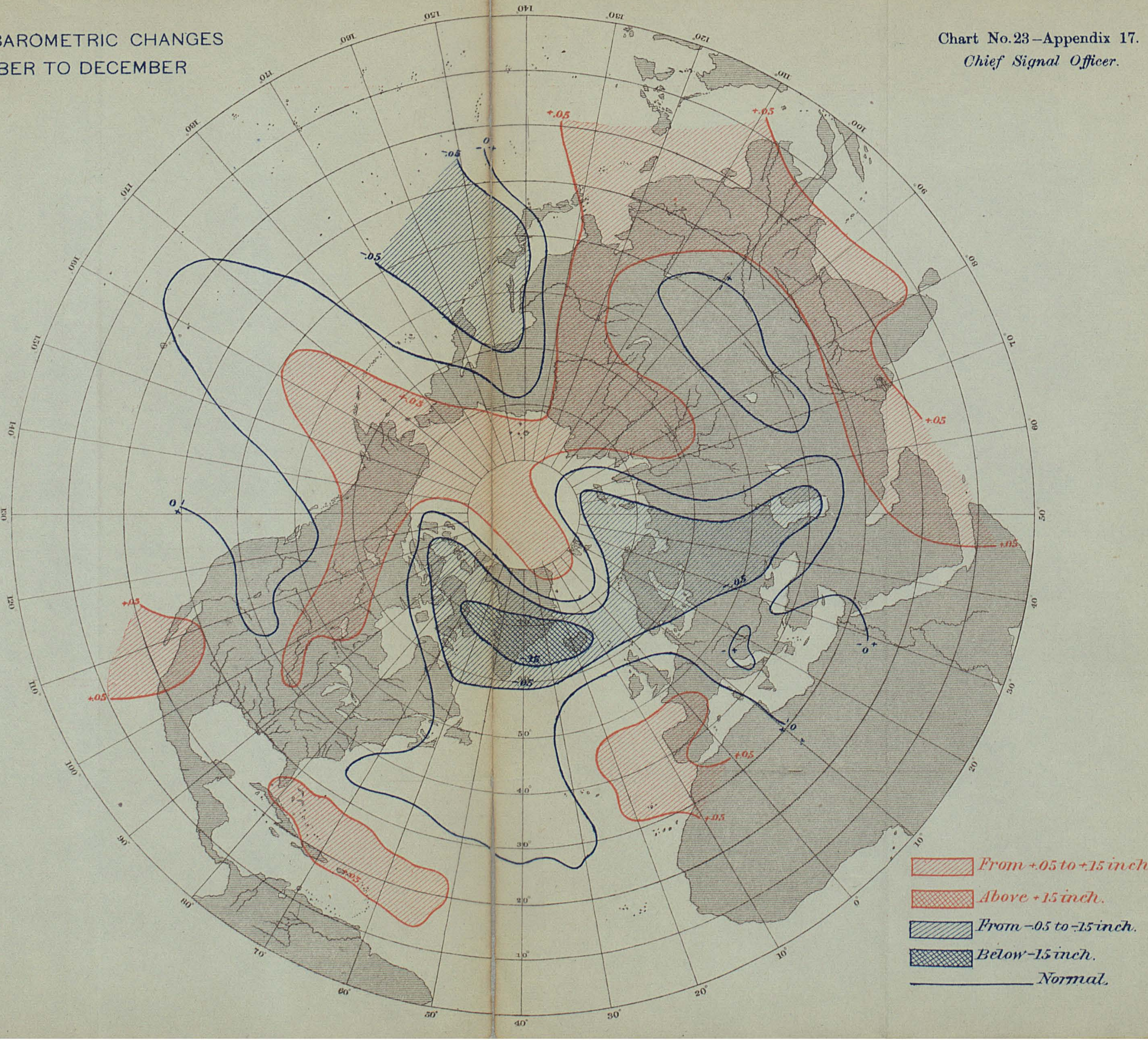
NORMAL BAROMETRIC CHANGES
OCTOBER TO NOVEMBER

Chart No. 22 -Appendix 17.
Chief Signal Officer.



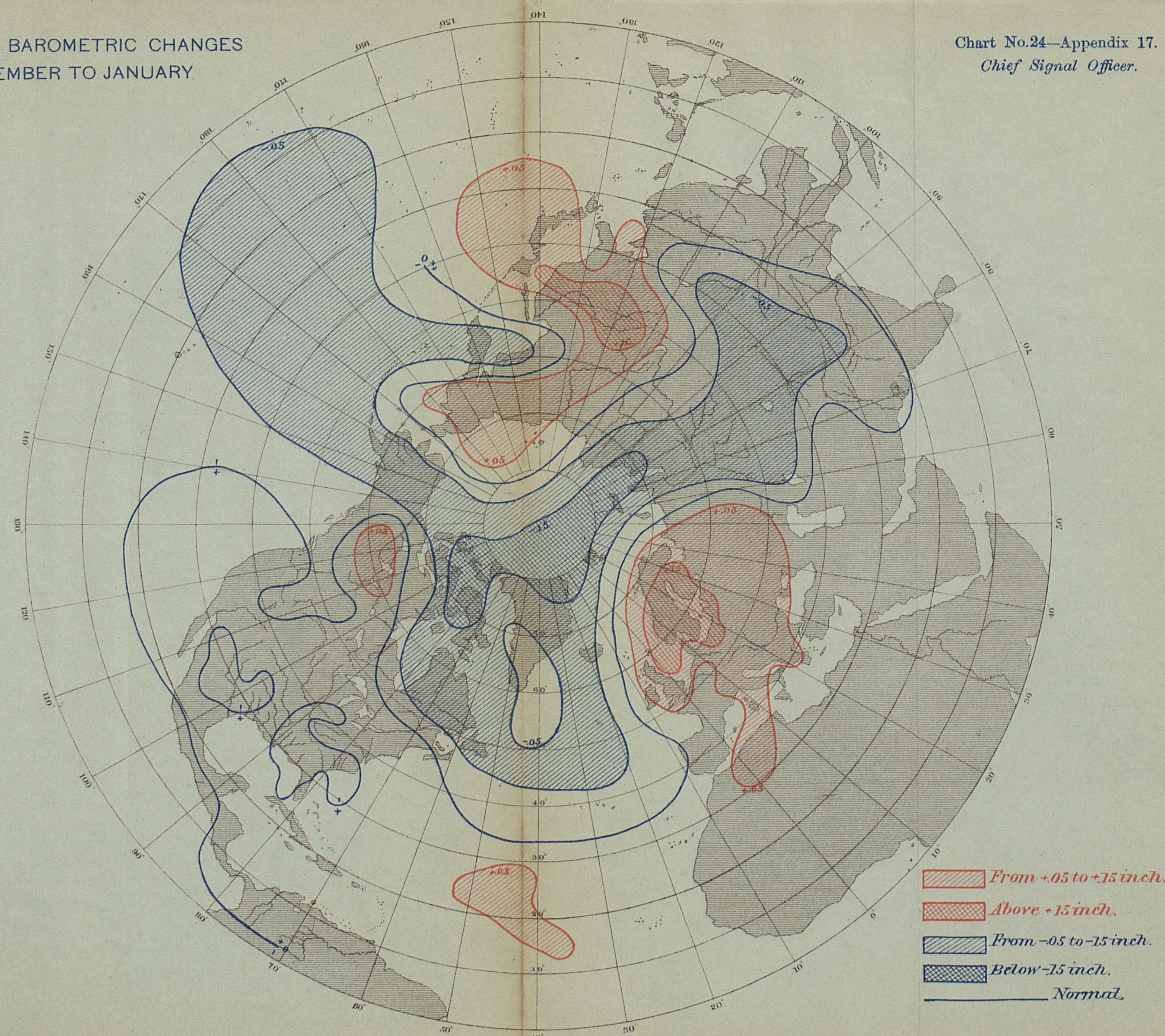
NORMAL BAROMETRIC CHANGES
NOVEMBER TO DECEMBER

Chart No. 23 – Appendix 17.
Chief Signal Officer.



NORMAL BAROMETRIC CHANGES
DECEMBER TO JANUARY

Chart No. 24—Appendix 17.
Chief Signal Officer.



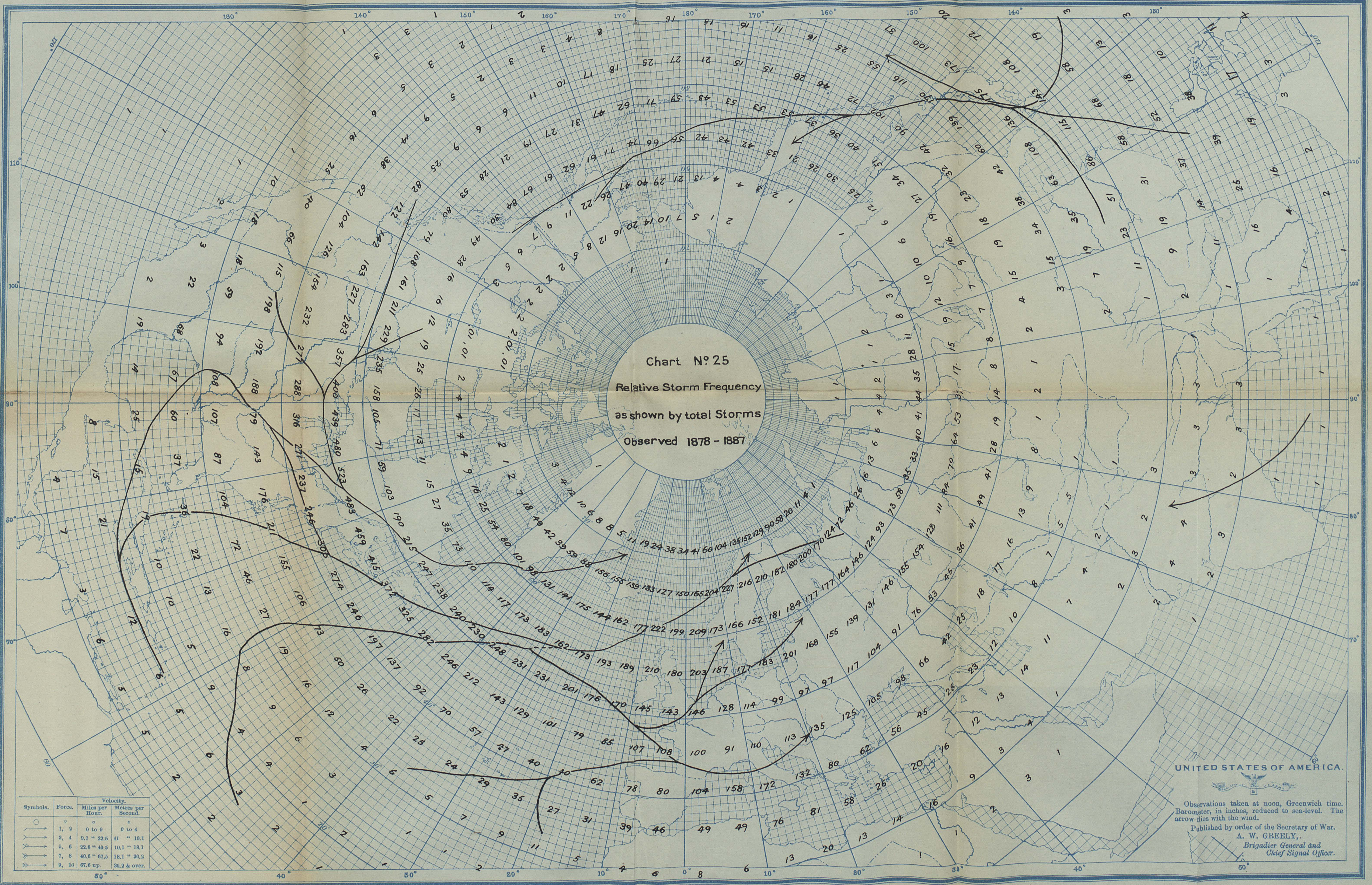


Chart No. 25
Relative Storm Frequency
as shown by total Storms
Observed 1878 - 1887
UNITED STATES OF AMERICA.
SIGNAL SERVICE U.S. ARMY
Observations taken at noon, Greenwich time. Barometer, in inches, reduced to sea-level. The arrow flies with the wind.
Published by order of the Secretary of War.
A. W. GREELY,.
Brigadier General and Chief Signal Officer.
Symbols. Force. Velocity. Miles per Hour. Metres per Second.
0 0 0
1, 2 0 to 9 0 to 4
3, 4 9.1 " 22.5 41 " 10.1
5, 6 22.6 " 40.5 10.1 " 18.1
7, 8 40.6 " 67.5 18.1 " 30.2
9, 10 67.6 up. 30.2 & over.